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A NEW SPHENOPHYLLALEAN SHOOT SYSTEM FROM THE PENNSYLVANIAN

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INTRODUCTION

Investigations of American coal balls from the Pennsylvanian by Andrews and Mamay (1951), Baxter (1950), Hoskins and Cross (1943), and Mamay (1954; 1959) have greatly enlarged the anatomical knowledge of Sphenophyllalean fructifications; however, new petrified vegetative remains have not been described.

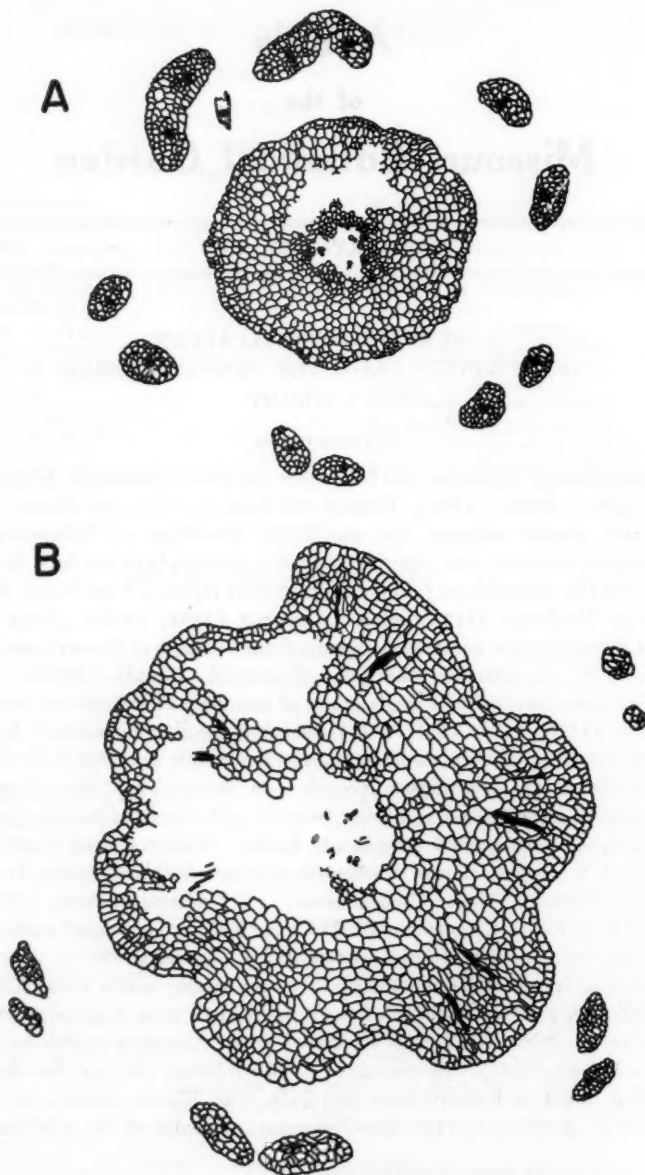
Sphenophylla referable to European species were reported from North America in Ohio by Newberry (1853) while Lesquereux (1858; 1860) among others, described numerous new compression species from Missouri to Pennsylvania. In a specimen of *S. emarginatum* from New Brunswick, Canada, Dawson (1865) found the xylem consisted of a single group of reticulate or scalariform vessels.

Renault (1870; 1873; 1876; 1878) published the first anatomical details of *Sphenophyllum* from silicified petrifications of France. He described *S. Stephanense* and *S. Renaultii* (*S. quadrifidum* Renault non Brongniart)¹ from Stephanian (upper-Upper Carboniferous) and lower Permian, and correlated petrifications with compressions in *S. cuneifolium* (Sternberg) Zeiller. Williamson and Scott (1894-5) described *S. insigne* (Lower Carboniferous) and *S. plurifoliatum* from the Lower Coal Measures (Upper Carboniferous). *S. Gilkineti* Leclercq (1925), *S. minus* and *S. perforatum* Koopmans (1928) were based on internodal anatomy and show insufficient distinction from *S. plurifoliatum*, (Baxter 1948).

Anatomical features thus far known have been largely drawn from *S. insigne*, *S. plurifoliatum*, and *S. Renaultii*; all were based upon some knowledge of node, leaf, and root. Additional details are known from American studies by Baxter (1948) and Reed (1949) who considered *S. plurifoliatum* adequate for the range of variation found in Pennsylvanian coal balls from Illinois, Indiana, Iowa, and Texas; further considerations are dependent upon knowledge of the nodal anatomy.

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¹ See Appendix.



Text Figure 1. *Spbenophyllum constrictum*, transverse sections.
A, Internode above (Slide 2743); B, Node (Slide 2739). $\times 20$.

MATERIALS

The following description was based upon nine plant fragments or groups of fragments.² Serial peels from such remains, with numerous other sections, were taken from three middle Pennsylvanian coal balls, two from Kansas and one from Indiana.

One was collected by Dr. Henry N. Andrews at a pit mine (Wasson Coal Mining Company) ten miles north of Booneville, Warrick County, Indiana. The coal is Petersburg or Alum Cave (Indiana No. 5 Coal) and correlative with Harrisburg (Illinois No. 5 Coal) of the Carbondale group, upper-middle Pennsylvanian. Two additional specimens were found by Dr. Sergius H. Mamay at a strip mine (Pittsburgh and Midway Coal Company) between West Mineral and Hallowell, Cherokee County, Kansas. The Fleming coal occurs in the upper part of the Cherokee shale, Des Moines series, middle-middle Pennsylvanian.

SPHENOPHYLLUM constrictum sp. nov.—General Description

Despite the generally parenchymatous nature of the plant, preservation is remarkably good. Various stages of development were preserved, which are referred to as young, mature, and old, although certainly they could represent portions of the same plant. The term young refers to portions displaying the primary body, often incomplete; mature, to secondary development without decortication; and old, to decorticated sections essentially of secondary tissue.

A comparative study of the plants from Kansas and Indiana was first initiated to determine their degree of similarity. Kansan material consisted of young and mature axes, and that of Indiana, mature to old. Mature stems in both provided bases for anatomical comparison. Figures 1 (Kansas) and 2 (Indiana) show the tissue relationships; anatomically, the two are not separable.

Nodal diameters of *S. constrictum* in mature stems are 4.5–5.0 mm. or about twice the internode of 2.5 mm.; the distance between nodes is 2.0 mm., resulting in a pronounced constricted appearance (fig. 4, 26). The shoot consists of a triarch exarch protosteles with an adjoining parenchymatous cortex so characteristic as to easily separate *S. constrictum* from all other reported Sphenophylla. Dichotomizing leaf traces supply six bifid sessile leaves which are verticillate and superposed.

Text figure 1B shows the radially symmetrical nodal cross-section with six ridges intervened by grooves (one ridge is shown in fig. 14). The ridges are the six verticillate leaf bases which are distinct only as an equal number of leaves arise. The four pairs of leaf tips shown peripherally are from the node below; in young stems with slight internodal elongation, leaves exceed the height of the node next above. Diverging lines in leaf bases indicate passage of the dichotomized veins.

Text figure 1A shows the more rounded and reduced outline of the internode and the six whorled leaves which arose from the node of 1B, 0.45 mm. below.

² Roman numerals after each figure explanation indicate from which of the nine specimens the picture was taken.

The bifid nature of each leaf becomes apparent beyond one-half to two-thirds of the distinct leaf distance from the fluted node. The two distal portions are uninerved and tapered, with papillate to apiculate tips. The leaves usually curve slightly upward, markedly so in young stems, or may project straight out from the foliar disc (text fig. 2A).

STEM—PRIMARY TISSUE

The vascular zone of a young stem may lack central cells, depending on metaxylem maturation, but there are several tracheids ($15\text{--}20\ \mu$) preserved at deltoid vertices (compare text fig. 1B with fig. 14).³ In mature primary wood, merging of metaxylem cells ($20\text{--}55\ \mu$) with the three protoxylem groups is imperceptible except by the striking diminution of tracheid size toward each protoxylem vertex and the annular and spiral thickenings of the latter.

Metaxylem tracheids are best described as scalariform-reticulate. Although the thickenings are predominantly reticulate, there is transverse elongation toward the protoxylem (fig. 5). Elliptical to circular perforations of the radial and tangential walls appear to be simple pits, but previous reports (Renault 1878; Baxter 1948) indicate this is common due to border degradation. If the pits were bordered, the borders were quite fragile. Disintegration of protoxylary tissue resulting in lacunae occasionally occurred, but was local and discontinuous.

The area around the protostele is usually empty, and phloem is lacking. However, intervening tissue was preserved in the apical portion (fig. 22). Metaxylem is absent, and in the center are pyrite grains, not to be confused with the three equally black, in reality brown, groups of cells, CE, which alternate with the protoxylem; one group is preserved, PX. The three clusters of dark cells, CE, filled with resinous material, consists of 5–7 cells each, which are polygonal ($40 \times 90\ \mu$) in transverse section and serially appear to be connected in a linear manner. What such tissue represents is questionable, because no evidence was found that it contributes to the V-trace from the stele. Remnants of such cells are referable to the alternating vestiges of text figure 1B (CE, fig. 13–14).

Remains more comparable to nutrient conducting tissue, 2–3 cells thick, are radial to the protoxylem and peripherally delimited by a one cell layer (fig. 22). Such cells ($20\text{--}30\ \mu$), when separated by a V-trace, apparently join adjacent traces. Longitudinally, as in figure 10, cells with abutting transverse walls, PH, may represent phloem elements ($130\text{--}150\ \mu$ long).

The primary cortex which directly adjoins the stele without a distinct endodermis or pericycle, is highly characteristic and separates *S. constrictum* from all previously reported Sphenophylla. The entire cortex is parenchymatous with isodiametric polygonal cells up to $150\ \mu$; other species have thicker walled cortical tissue and occasionally remnants of an inner thin-walled cortex. The cortex accounts for four-fifths of the cauline diameter, and nodally there is no distinction

³ The term tracheid is used in all cases referring to xylary elements, but this in no way obviates the controversy of tracheid versus vessel (tracheae) in *Sphenophyllum*.

between this tissue and the leaf base. The cortical dimensions are extremely flexible due to secondary growth which resulted in internal compression and eventual decortication.

Parenchymatous tissue of the cortex and leaf is bounded by a layer of rectangular epidermal cells ($40 \times 80 \mu$ transversely), which often lack uniformity in shape and size. Epidermal cells are usually filled with brown to black residual matter, also seen in underlying cortical cells. In young plants, as in figures 26–30, cellular contents form a scattered pattern in the cortex, diminishing centripetally. In mature stems, most cortical cells are characterized by such residue, as in figures 1, 2, 9, and 10. In figure 7, a comparison in residual contents and relative development is shown between a main axis, A, and its branch.

STEM—SECONDARY TISSUE

Decorticated stems with abundant secondary wood present a problem of identification, but in several cases the distinct primary cortex was not completely obliterated (C, fig. 6).

Tracheids increase in size centrifugally in concentric and vertical rows, and those opposite primary xylary vertices often show little distinction from others. The number of concentric rows opposite sides of the triquetrous primary wood, however, need not be equal (fig. 12); this is common in *S. plurifoliatum*. Reticulate bordered pitting is more abundant on radial walls, and pits without borders resemble perforations of the metaxylem. Truncate tracheidal angles indicate un-preserved vertical parenchyma cells (PC, fig. 6).

Secondary phloem was absent, and there was always a gap between the wood and periderm. Periderm cells are $75\text{--}100 \mu$ long and often contain carbonaceous residue. The compact periderm gives way to a black amorphous tissue which clearly delimits the cortex.

LEAVES

Thin walled epidermis is covered by a scant cuticle, lacking in most cases; in direct contrast, *S. plurifoliatum* and *S. Renaultii* have a thickened epidermis. Stomata seems to be very scarce, but an opening suggestive of such, ST, from a transverse section of lower epidermis, is shown in figure 23. Cutinized structures on either side may represent guard cells, and behind is perhaps the slightly recurved margin of a guard cell. Other possible stomata have been reported by Renault (1876) in *S. Renaultii* and by Reed (1949) in *S. plurifoliatum*; openings were embraced by guard cells flush with the lower epidermis.

At nodes where branches were not observed, the pattern of leaf traces in the cortex is similar to other species, differing in relative position and number of ultimate veins. One V-trace originates from each protoxylem group. Six leaf traces horizontally tranverse the cortex to an equal number of fluted leaf bases. Actual connection of traces to the stele is not seen in mature plants with tissue lacking between wood and periderm, but distortions of the intervening tissues indicate the vascular passage (fig. 9). In stems with abundant secondary tissue, all

such evidence is lost. In the apical region, the V-trace was seen in connection with the protoxylem, which is clearly singular despite the twin trace emanation.

At the leaf base, the course of the trace descends slightly, gradually turns upward (LT, fig. 26) and then dichotomizes (B, fig. 10), supplying each leaf with a pair of veins. Text figure 1B (compare with fig. 14) shows a transverse section of leaf bases passing through the two veins indicated by heavy black lines; tips of four leaves from the node below are radial to the leaf bases. Figure 13, slightly oblique, shows partial separation of a leaf from the foliar disc and subsequent median constriction. Figure 15, from the apex, shows two superposed leaves almost divided. The ultimate tips of a leaf are seen in figure 8. The resulting verticillate phyllotaxy with leaves divided is shown in text figure 1A. The leaves appear elliptical to circular in cross-section and lack the more angular margins of other species.

Figure 11 (leaf enlargement from fig. 26, upper left) shows the undifferentiated mesophyll merging into the cortex without distinction. Epidermal and peripheral cortical cells characteristically have black-brown contents.

Vascular elements of the leaf consist of a concentric bundle of five to seven elements (V, fig. 8); tracheids are known from ringed and helical remnants. In a well preserved leaf section (LT, fig. 11) elongated thin walled elements with cross-walls are seen. Encircling the leaf supply is a one cell layer with brownish content (LT, figs. 28-29). The conducting system terminates near each bifid tip without further ramification.

BRANCHING

Branches were preserved in several developmental stages: primordial leaves (figs. 28-30), an elongated internode (fig. 31), and mature shoots (figs. 7, 32-33). They arise laterally in a variable association with leaves and are solitary at the nodes, but two are not uncommon. The branch trace originates at a vertex of the protostele, consequently, each branch is associated with one of three possible sets of leaves which derive their V-trace from the same vertex. When a branch arose, the V-trace of two associated leaves appeared to emanate with the branch trace, adjoining it below or laterally for a short distance.

Oblique cauline sections longitudinally through a nascent branch, as in figure 24 (enlargement of B, fig. 28), indicated the branch arose directly above a leaf by its relationship to the leaf trace, LT. Transverse serial sections of the young stem shown in text figure 1 presented two different branch-leaf relationships. In one case, a young branch apparently occupied the spatial position of the sixth leaf (text fig. 2A); the leaves extend straight out in the lower portion of this stem. Several peels later, the sixth and subtending leaf was seen in a mechanically displaced position similar to that in figure 29. Such growth between crowded superposed leaf whorls not only tends to push down the subtending leaf, but to displace the axis slightly. With subsequent growth, the branch slips toward one side of the leaf above. In a second case, two nodes lower, the branch arose almost exactly above and between two leaves. Such patterns were compared with other cases of branching; where the relationship of branch and leaf was ascertainable, branching

was as variable as the two extremes cited. Young branches as in figures 24, 28–31, and the above cases had no adventitious roots.

BASAL STEM

The unique axis of figure 19 was found adjacent to the stem of figures 26–27. The section was serially peeled on four faces, and with 1.9 mm. of matrix removed from each, the axis abruptly came to an end with the emanation of several roots. Organic connection of either end with other fragments was not established, but anatomical comparison and association leave little doubt of unity with *S. constrictum*. From the larger diameter and emanating roots, it is considered the lower portion of a shoot.

A perpendicular bisect of the triquetrous stele is about 0.9 mm.; cells range from 20–75 μ . The entire structure is 5.9 mm. in its largest dimension. The three cortical flares represent modifications of the foliar disc, below which a reduced rounded internode was seen.

Lacunose structures of the three cortical flares are characteristic of the entire stem portion, although some have been altered by degradation. Consequently, some peripheral lacunae of the cortex open to the exterior; others do not. The lack of foreign material in such cavities indicates they were originally closed and perhaps aerenchymatous in nature, though some may have possessed openings permitting the entrance of one to three spinose spherical bodies, 50 μ in diameter, which occurred in several chambers, but were not identified.

STEM APICES

The apex is shown longitudinally in figures 24 and 31, and obliquely transverse in figures 20 and 25. The cortical area of cell elongation is discernible (C, fig. 31), but vascular tissue is indistinct and completely obscure near the tip. In fig. 20, concentrically arranged cells indicate the proximity of the meristematic region, MR; fig. 25 is 0.7 mm. higher. Preservation above the stelar area was lacking, and the actual nature of apical division is speculative. Sections from apices indicate the newly formed cells are in a slightly domed series of uniform layers (fig. 24).

Spheroidal chambers, 70–120 μ in diameter, adjoining the adaxial leaf surface and frequently above a vein, were present in one apex (AC, figs. 20, 25) from the foliar disc to leaf bifurcation (AC, fig. 15). They result in slight to prominent bulges above the epidermis, but each cavity is apparently sealed by a layer of cuticle continuous with that of the epidermis (fig. 21). In no cases were they open to the exterior, even by degradation. Most chambers are devoid of contents; a few possessed small amounts of residue, and none exhibited internal structure.

Thin-walled cells delimit the remaining spheroidal space suggesting a structure of gaseous content. If air chambers, they may be analogous to a modified stomatal apparatus in which the stomatal cleft has permanently been roofed over with cuticle. Cavities are lacking or undiscernible elsewhere in the same and other stems, except in a few cases where they do not adjoin the epidermis, being separated by one to several cells (fig. 26, C). However, one lower stem fragment was characterized by lacunose areas.

ROOTS

Adventitious roots of *S. constrictum* are about 0.35 mm. in diameter, and their stelar size is denoted by the black endodermal ring (EN, fig. 17).

Delimitation of the root cortex from that of the stem is shown longitudinally in fig. 26. Figure 27 shows the root-stem vascular connection which is internodal even in such condensed articulations. Adventitious roots occurred singly or were abundant around branch bases. Branches up to the stage of development shown in figure 31 lack roots; this suggests the time sequence of root initiation. Roots emanated from branches in an adaxial to abaxial orientation, and remained singular or immediately bifurcated (figs. 32-33). Vascularization is near the main axis, but the root connection is with the branch and not at the node of the main axis. Adventitious roots were seen emanating from all parts of the stem except between leaves.

Larger roots were found attached to the axis in fig. 19. The root in fig. 16, 0.75 mm. in diameter, has two groups of uniformly small ($12\ \mu$) cells (5-6) near the center; from other sections the primary wood can not be described with certainty. Pitting of the secondary xylem is similar to that of the stem, but borders were not preserved (fig. 18). Periderm cells are $35-40\ \mu$ wide and compressed at their extremities merging with black amorphous tissue. Transversely, cells of the cortex are rectangular to polygonal and as large as $40 \times 100\ \mu$. Brown cellular contents typical of the cauline cortex are present.

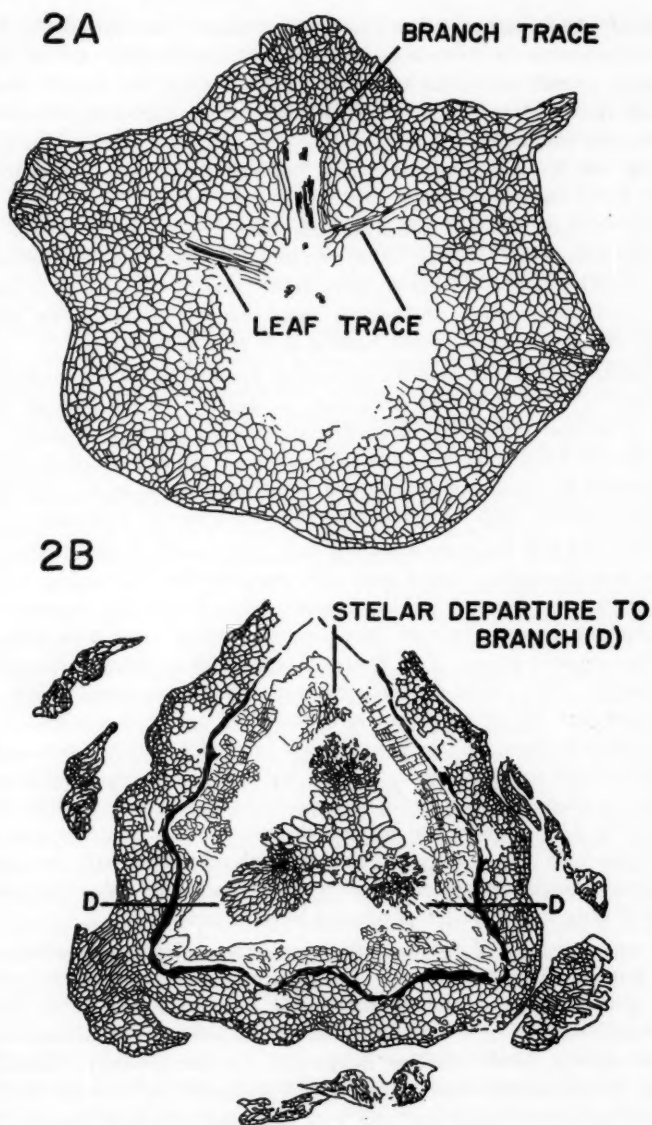
DISCUSSION

The cellular structure of the cortex and leaves of *S. constrictum* is quite distinct from that of other species; the cells are, throughout, uniformly thin-walled to a degree that suggests a plant of succulent habit. Although *S. Renaultii* and *S. plurifoliatum* have thin-walled inner cortical tissue, other differences between the two and *S. constrictum* are quite noticeable. Also, the ratio of cortical to xylary tissue in young stems is conspicuously greater than for other species.

The nodal diameter of *S. constrictum*, 4.5-5.0 mm., is comparable with those of *S. plurifoliatum* (4-6 mm.), *S. Renaultii* (3.6 mm.), and *S. Stephanense* (4.0-5.5 mm. *S. Renaultii* is the only petrified species with a smaller internodal diameter (2.2 mm.) than *S. constrictum* (2.5 mm.). The nodes of *S. constrictum* are 2.0 mm. apart, markedly less than *S. Renaultii* (6-7 mm.) or *S. Stephanense* (10 mm.).

A perpendicular bisect of the primary wood in *S. constrictum* is 0.2-0.3 mm. compared to 0.4 mm. in *S. plurifoliatum* (Baxter 1948) and 1.0 mm. in *S. insigne* (Bower 1930). In addition to smaller size, the primary xylem in *S. constrictum* is very subject to degradation and crushing.

Sphenophyllum, in general, displays a distinctive leaf trace pattern, and *S. constrictum*, with three dichotomized V-traces, represents one of the simplest types. One or more traces may enter the leaf base in *Sphenophyllum*, with the number of terminal vein divisions usually coinciding with foliar segments or dentations (Renault 1882). Each leaf of *S. constrictum* has two ultimate veins



Text Figure 2. Nodal transverse sections with branch origins.
2A, *Sphenophyllum constrictum* (Slide 2730); 2B, *S. plurifoliatum* (Slide 1539). $\times 17.5$.

and is bifid. Dichotomized foliar segments and venation are common in *Sphenophyllum* but not to the diminutive extent as in *S. constrictum*. Of the eighteen compression species recognized by Abbott (1958) from the United States and Canada, *S. fasciculatum* (Lesquereux) D. White has the most similar leaves in size and form (six bifid leaves 1-4 mm. long). *S. fasciculatum* also exhibits frequent branching and is known only from the middle-Pennsylvanian (Allegheny) of Missouri, Ohio, and Pennsylvania.

Nodal adventitious root connection has been reported in *S. insigne* (Scott 1920) and *S. Renaultii* (Renault 1878) but such attachment was not figured until Baxter (1948) found that roots occurred at any part of the stem in *S. plurifoliatum*. In *S. constrictum*, adventitious roots occur internodally but are most abundant in the vicinity of branch bases as in *S. plurifoliatum*.

The relative position of branch and leaves in *Sphenophyllum* has not been clear; Grand'Eury (1877) described branching as axillary; Solms-Laubach (1891) termed it obscure but axillary according to previous workers; Renault (1876; 1878) reported a branch between two adjacent leaves and also described an axillary swelling which he thought might be a bud, and later, in 1896, he described branching as extra-axillary, with some branches exhibiting a sort of dichotomy.

Detailed and illustrative evidence was first presented by Baxter (1948) showing three branches arising from a node of *S. plurifoliatum*. According to Baxter, branch origins were between adjacent leaves. Slides 1538-1542 representing the serial branching sequence indicate there were subtending leaves preserved at two of the three branch vertices. Text figure 2B (from slide 1539 referable to fig. 19, pl. 15, Baxter 1948) shows a nodal cross-section with remnants of eight leaves, two opposite each side of the stem and indicative of one at each angle. In such an interpretation, there are nine leaves in this form of *S. plurifoliatum*, and each of the three branches arose directly above a leaf. In *S. constrictum* the branches arose in a variable relationship with two associated leaves, from directly above a leaf (text fig. 2A) to above and between the two leaves. Text figure 2A shows five leaf bases with that of a branch above the sixth subtending leaf. In summary, the evidence available at present suggests that branches in *Sphenophyllum* may originate directly above a leaf or above and between two leaves.

The suggested habit of *Sphenophylla* ranges from suffrutescent herbs to lianas with an aquatic to terrestrial habitat. Hydrophytes have been repeatedly ruled out, and the genus has been considered ecologically as a whole because the anatomy was essentially similar. Previous species lacked the aerenchymatous tissue usually found in aquatics (Podostemaceae excepted). On the contrary, *Sphenophylla* exhibited a thick-walled outer cortex, leaves reinforced by sclerotic cells with substantial epidermal thickening, and well developed, extensive vascular tissue; all are indicative of a plant adapted to land (Reed 1949). Size and habit from compression forms, some with dorsi-ventral verticils, further substantiated a scrambling or climbing liana.

In *S. constrictum*, epidermal and cortical tissue is thin-walled, and development of wood is more meager than in other species. Though the nature of chambers in the apical portion is dubious, the cortical structure of a lower stem fragment is lacunose. Such evidence infers a semi-aquatic habitat. Lack of mesophyll differentiation and limited cuticular development conform with such an inference (Arber 1920). The abundant thin walled cortical tissue, short internodes, and forked needle-like leaves suggest a succulent plant, though the epidermal walls are relatively thin and the cuticle scant. The character of peripheral cellular contents of the plant would also have a bearing on water retention or loss (Maksimov 1929), but the nature or significance of the characteristic cellular residue in stem and leaf is only conjectural.

Stems of described *Sphenophylla* probably were aerial, but it is likely that basal anchoring was frequently submerged in their swampy environment (Arnold 1947). Divergence in habitat of *S. constrictum*, indicated by anatomy and habit, from the contemporary coal ball species, *S. plurifoliatum*, may not be as drastic then as first envisioned. Both species were found in the same coal balls, though the former was better preserved.

Rhizonium verticillatum Williamson (1889), of the heterogeneous root genus established by Corda (1845), is strikingly similar to *S. constrictum*. An examination of slides 1234 and 1909 (Williamson Collection) confirms Williamson's descriptions and figures (162-3, figs. 16-21, 1889); however, the axes are those of stems with verticillate leaves rather than of roots with rootlets. Seven nodes are shown in longitudinal section, 1.6 mm. apart, 1.5 mm. in nodal diameter, and 1.2 mm. internodally. The metaxylem of the triarch exarch protostele is clearly scalariform and distinctly different from that of *S. constrictum*. A perpendicular bisect of the xylem is 0.14-0.18 mm.; there are no secondary tissues. Indistinct tissue surrounding the xylem adjoins the parenchymatous cortex which is thin-walled, the outermost cells (2-3) slightly thicker, homogeneous, and continuous with that of the leaves; this was apparently succulent in nature and remarkably like that of *S. constrictum*. Amber colored cellular residue is lacking. The leaves are about 1.5 mm. in length, but the actual number and nature of their tips can not be determined from the thin sections. *R. verticillatum* apparently represents a form of *Sphenophyllum* previously overlooked in the Coal-Measures of England and is quite similar to *S. constrictum* from American coal fields.

SPHENOPHYLLUM constrictum Phillips, sp. nov.

Diagnosis: Articulated stem, 4.5-5.0 mm. nodal diameter (less than 6.0 mm.), 2.5 mm. internodal diameter, 2.0 mm. between nodes; exarch, triarch protostele, primary bisect 0.2-0.3 mm., metaxylem pitting scalariform-reticulate; tracheids of secondary wood radial to protoxylem often show little distinction from others in size, pitting bordered-reticulate; compact internal periderm bordered by black amorphous tissue; cortex and epidermis of thin parenchymatous tissue with dark residual contents, cortex of lower stem lacunose, air chambers scant elsewhere; cuticle thin or absent.

Leaves six in each verticil, not over 1.5 mm. long, bases fused and bifid in distal portion, circular to ellipsoidal in cross-section, cellular structure continuous with that of cortex, probably succulent in life; vascular supply initiates as 3 V-traces which divide in cortex to 12 with one strand entering each bifid segment.

Lateral branches originate above leaf or above and between leaves.

Adventitious roots, 0.35–0.75 mm. diameter, primary xylem not determined, rectangular to polygonal cortical cells with characteristic cauline contents, secondary tissue similar to stem, attachment internodal to vicinity of node.

Holotype: Slides 2641–2790 from WCB# 1026, paleobotanical collections of The Henry Shaw School of Botany, Washington University.

Locality: Hallowell-West Mineral, Cherokee County, Kansas

Horizon: Fleming, Des Moines Series, middle-Pennsylvanian

Paratypes: Slides 2791–2829 and WCB# 921-2-3A-3B

Locality: North of Booneville, Warrick County, Indiana

Horizon: Petersburg V, middle-Pennsylvanian

Paratypes: Slides 2830–2910 and WCB# 1025 D-E-F

Locality and Horizon of Holotype.

SUMMARY

Developmental stages, including lower stem and apical portions, of a new vegetative shoot system, *Sphenophyllum constrictum*, were described from the middle-Pennsylvanian of Indiana and Kansas. Branch origins were found to be directly above to above and between leaves and adventitious roots emanated internodally to nodally, more frequently at branch bases. The following features of *Sphenophyllum* were exhibited by the new species.

1. Exarch triarch protostele.
2. Six sessile superposed verticillate leaves supplied with dichotomized V-traces.
3. Compact periderm and secondary xylem with intercellular spaces at truncate tracheidal margins and reticulate bordered pitting.

The following different characters easily distinguish *S. constrictum*:

1. Epidermal and cortical tissue consists of thin-walled cells with dark residual contents; lower stem with lacunose cortex. The cortex of stems without secondary growth constitutes as much as four-fifths of the diameter.
2. The leaf supplies are derived from three dichotomized V-traces which give rise to twelve veins, two per leaf, one for each bifid segment.
3. The six bifid leaves are 1.5 mm. or less in length from a foliar disc 4.5–5.0 mm. in diameter, with internodal diameter of 2.5 mm. and 2.0 mm. between nodes; the constricted outline is evident in all but transverse sections and decorticated material.

ACKNOWLEDGMENTS

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APPENDIX

Renault referred to *S. quadrifidum* Renault (non Brongniart) both as a species and subspecies, (*S. angustifolium* (Germar) Goeppert subsp. *quadrifidum* Renault), although the latter never appeared as a combination. A new specific epithet is proposed with the below listed type description citation and subsequent illustrative references:

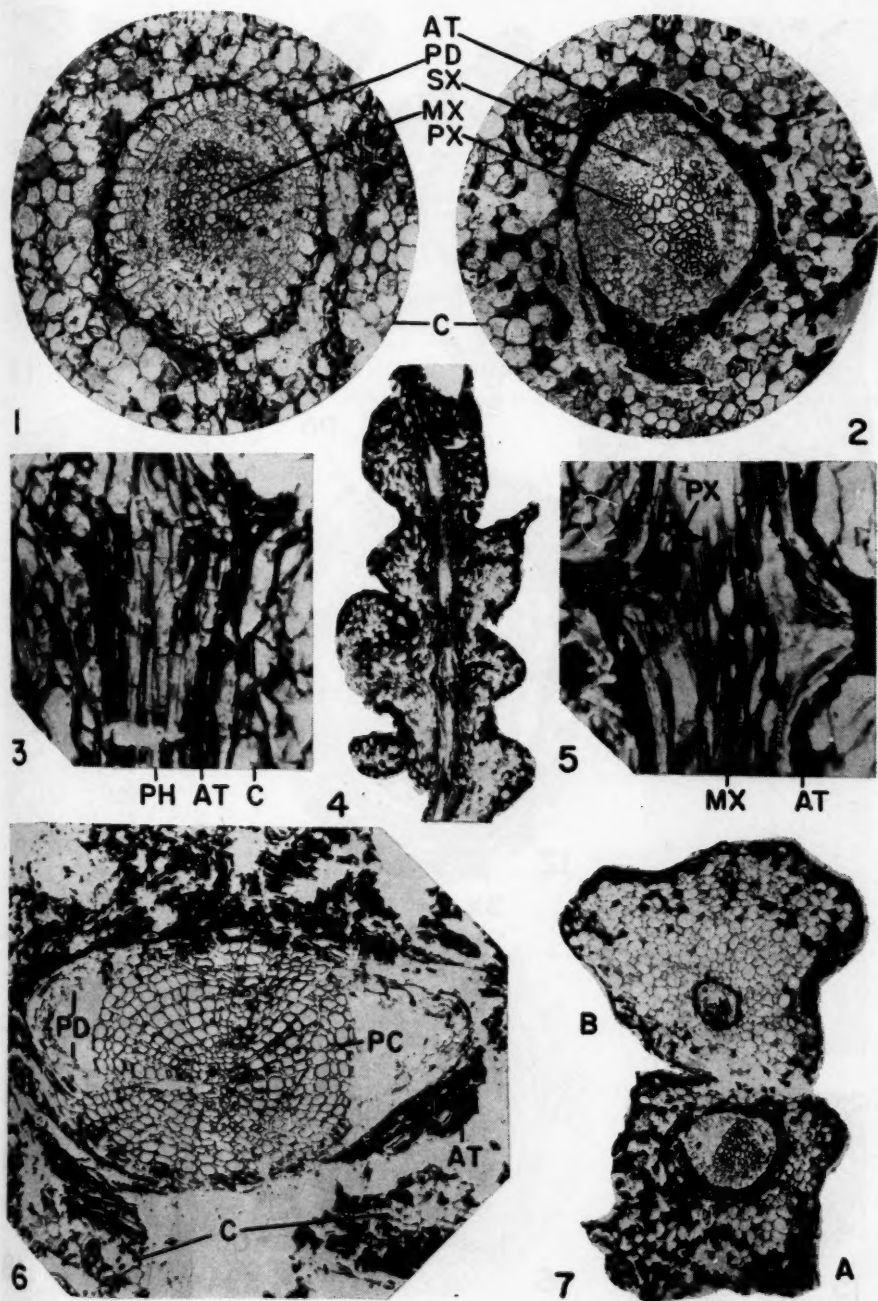
SPHENOPHYLLUM *Renaultii* Phillips nom. nov.

- 1876 *Sphenophyllum quadrifidum* B. Ren., Végétaux Silicifiés d'Autun et de Saint-Étienne, Nouvelles Recherches sur la Structure des Sphenophyllum et sur Leurs Affinités Botaniques, *Annals des Sciences Naturelles*, sér. 6, Botaniques, 4:293-299, pl. 7, figs. 1-3, non Brongniart, 1828, *Prodrome d'une Histoire des Végétaux Fossiles*, p. 76 (68).
 1878 *S. quadrifidum* in Renault, Recherches sur la Structure et les Affinités Botaniques des Végétaux Silicifiés, Autun, 178-183, pl. 28, figs. 1-2.
 1880 *S. quadrifidum* in Schimper, in Zittel, *Handb. Paläont.*, 177, Fig. 134, 1-3.
 1882 *S. quadrifidum* in Renault, Cours de Botanique Fossile, 2:89, 93-97, pl. 15, figs. 1-3.
 1887 *S. quadrifidum* in Solms-Laubach, *Einl. Paläophyt.*, 356, Fig. 48, 1-3.
 1891 *S. quadrifidum* in Solms-Laubach, *Fossil Botany*, Oxford, 347, text fig. 48, 1-3.
 1900 *S. quadrifidum* in Scott, *Studies Foss. Bot.*, 83, text fig. 34; 2d ed., 1908, 1:80, text fig. 36; 3d ed., 1920, 1:79, text fig. 38.
 1927 *S. quadrifidum* in Hirmer, *Handb. Paläobotanik*, 351, 353, Fig. 410.
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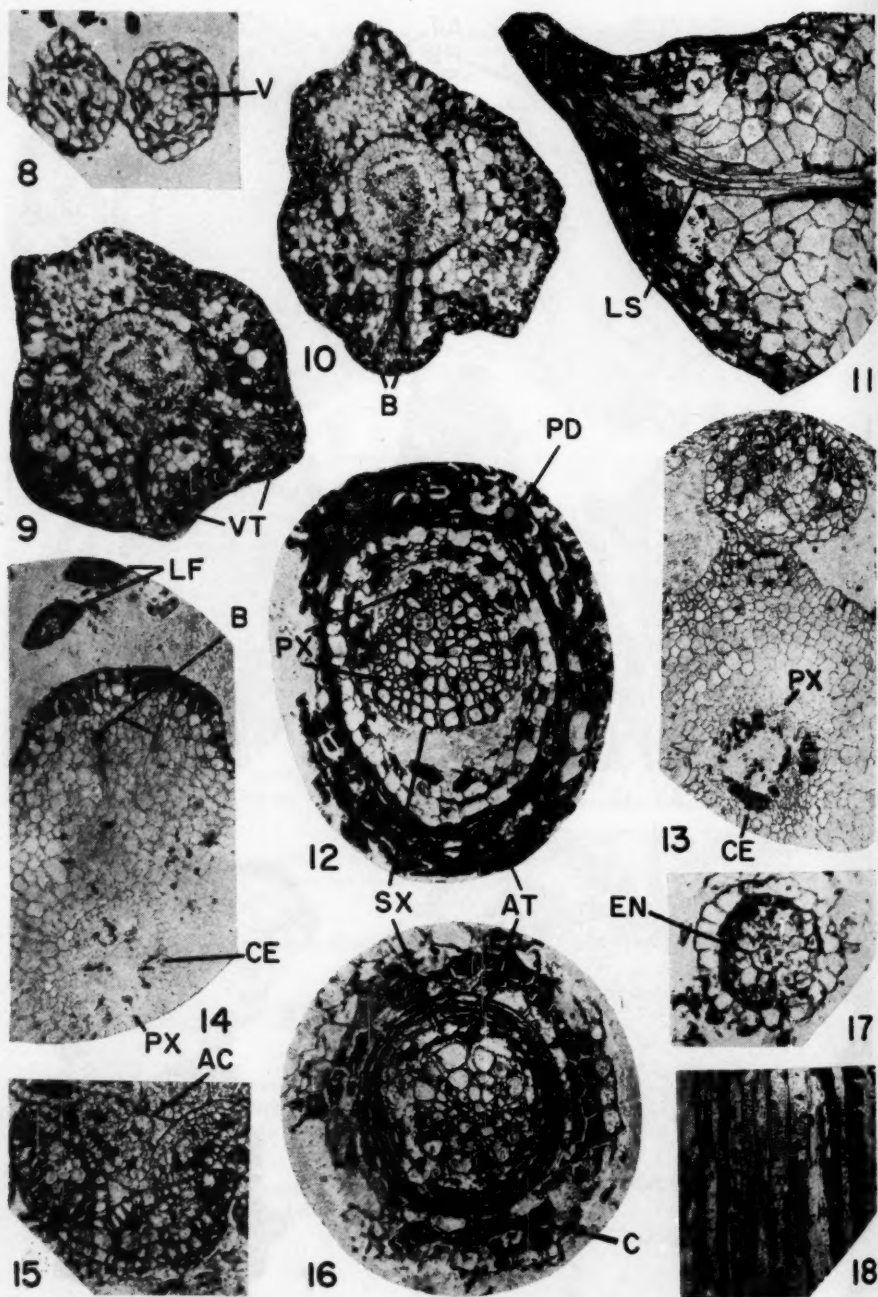
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| Figure 1. | Transverse section of mature stem from Kansas. MX, metaxylem; PD, periderm; C, cortex. | |
| | Slide 2856 | IX |
| | × 35 | |
| Figure 2. | Transverse section of mature stem from Indiana. PX, protoxylem; SX, secondary xylem; AT, amorphous black tissue between periderm and C, cortex. | |
| | Slide 2800 | VII |
| | × 35 | |
| Figure 3. | Enlarged longitudinal section of mature stem shown in fig. 4. PH, possible phloem; AT, amorphous black tissue; C, primary cortex. | |
| | Slide 2797 | VI |
| | × 58 | |
| Figure 4. | Longitudinal section of mature stem showing four nodes, from Indiana. | |
| | Slide 2797 | VI |
| | × 7 | |
| Figure 5. | Enlarged longitudinal section of mature stem shown in fig. 4. PX, protoxylem; MX, metaxylem; AT, amorphous black tissue. | |
| | Slide 2797 | VI |
| | × 58 | |
| Figure 6. | Transverse section of stem. PC, spaces at the truncate margins of secondary xylem indicating unpreserved parenchyma; PD, periderm; AT, amorphous black tissue; C, vestiges of sloughed off cortex. | |
| | Slide 2796 | VI |
| | × 22 | |
| Figure 7. | Oblique transverse section of main axis, A, and branch, B. Note the residual cellular content pattern and the stellar development. | |
| | Slide 2803 | VII |
| | × 9 | |



PHILLIPS—SPHENOPHYLLUM CONSTRICTUM



PHILLIPS—SPHENOPHYLLUM CONSTRICTUM

EXPLANATION OF PLATE

PLATE 2

Sphenophyllum constrictum sp. nov.

- Figure 8. Transverse section of the two tips of a leaf taken from the apex. V, vein.
Slide 2723 $\times 112$ I
- Figure 9. Transverse section of mature stem. VT, V-trace or twin traces passing through the periderm, black amorphous tissue, and cortex.
Slide 2856 $\times 18$ IX
- Figure 10. Serial peel sequence of figure 9; B, one leaf trace of V-trace divided into two veins.
Slide 2856 $\times 18$ IX
- Figure 11. Enlarged longitudinal section of leaf of figure 26, upper left. LT, elongated conducting elements. Note undifferentiated mesophyll of leaf and leaf base.
Slide 2761 $\times 35$ III
- Figure 12. Transverse section of a decorticated branch. PX, protoxylem; PD, periderm; AT, black amorphous tissue, SX, secondary xylem. Note unequal development of secondary xylem.
Slide 2799 $\times 63$ VII
- Figure 13. Sector of oblique transverse section from young stem showing a leaf almost separated from the foliar disc. PX, protoxylem; CE, tissue referable to that in figs. 14, 22.
Slide 2708 $\times 35$ I
- Figure 14. Sector of transverse section from young stem. LF, two tips of a leaf from node below; B, two veins cut tangentially in leaf base; CE, tissue of uncertain nature which alternates with the protoxylem, PX.
Slide 2739 $\times 35$ II
- Figure 15. Oblique transverse section from apex. Two superposed bifurcating leaves from successive nodes. AC, chamber bulging out on upper epidermal leaf surface.
Slide 2717 $\times 63$ I
- Figure 16. Transverse section of mature root. SX, secondary wood; AT, amorphous black tissue; C, cortex.
Slide 2762 $\times 63$ IV
- Figure 17. Transverse section of young adventitious root. EN, endodermal ring.
Slide 2879 $\times 58$ VIII
- Figure 18. Oblique longitudinal section of mature root showing reticulate pitting of the secondary xylem.
Slide 2760 $\times 63$ IV

EXPLANATION OF PLATE

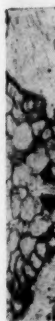
PLATE 3

Sphenophyllum constrictum sp. nov.

- Figure 19. Oblique transverse section of the lower stem. L, lacunae of the primary cortex.
Slide 2757 × 12 IV
- Figure 20. Oblique transverse section from apex of stem shown in figs. 28-30. MR, young cells near the meristematic region; AC, two of three chambers shown adjoining the upper epidermis of the leaf.
Slide 2715 × 35 I
- Figure 21. Oblique transverse section through a chamber, AC, on the upper epidermis of a leaf. The chamber is roofed over by cuticle.
Slide 2718 × 63 I
- Figure 22. Transverse section of stem near apex. PX, one preserved protoxylem group; CE, groups of cells with brown residual content; note they alternate with protoxylem groups.
Slide 2695 × 58 I
- Figure 23. Transverse section of lower epidermis or epidermis of leaf base. ST, perhaps a stoma with cutinized guard cells on each side and the thickened recurved margin of a guard cell behind.
Slide 2745 × 112 III
- Figure 24. Longitudinal section of nascent branch directly above a leaf indicated by LT, leaf trace. Enclosed by three primordial leaves is the meristematic region, MR. Enlargement of B, fig. 28.
Slide 2659 × 35 I
- Figure 25. Serial sequence 0.7 mm. above fig. 20 in apex showing young leaves. AC, chamber on upper epidermis.
Slide 2720 × 35 I



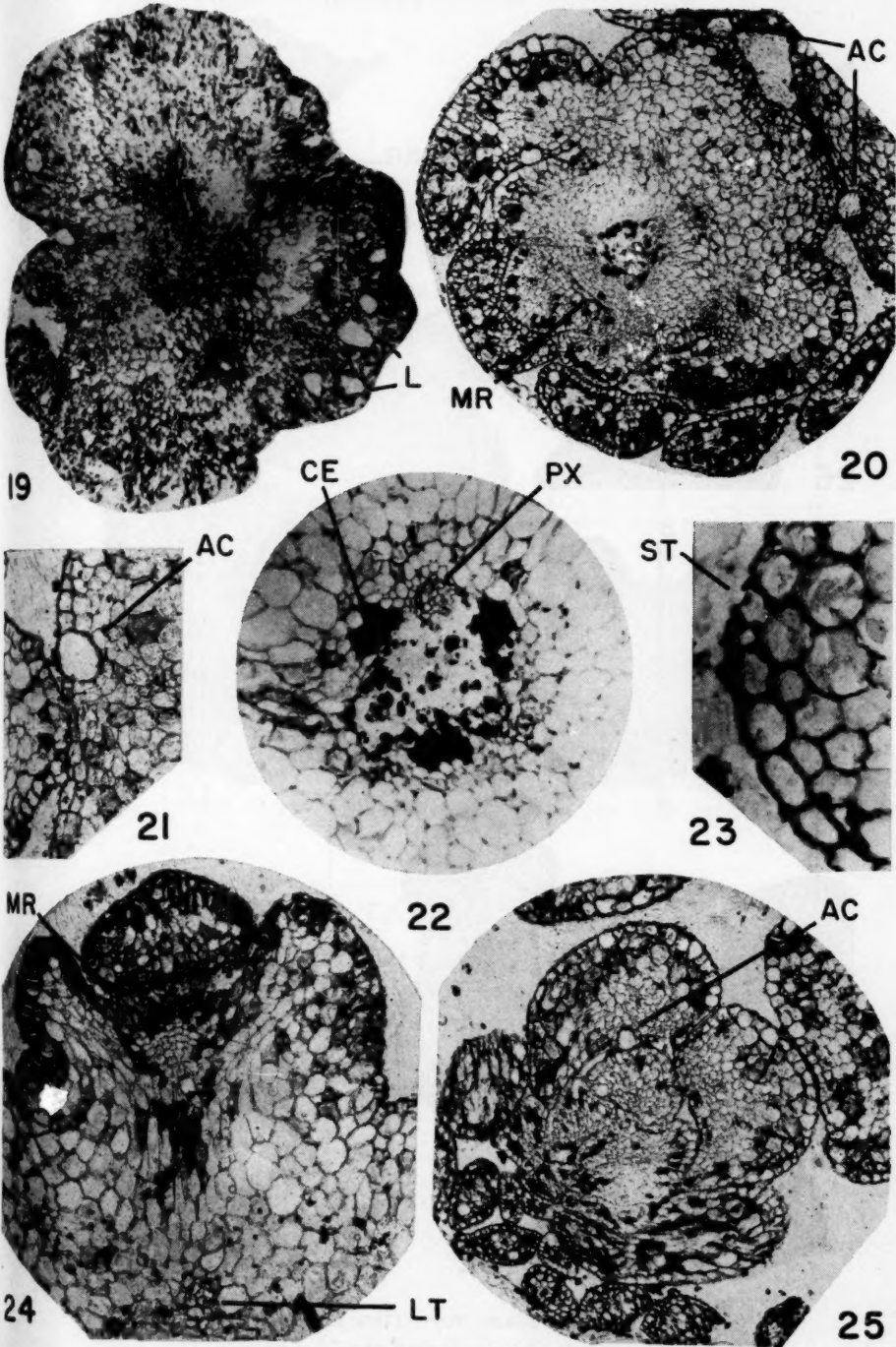
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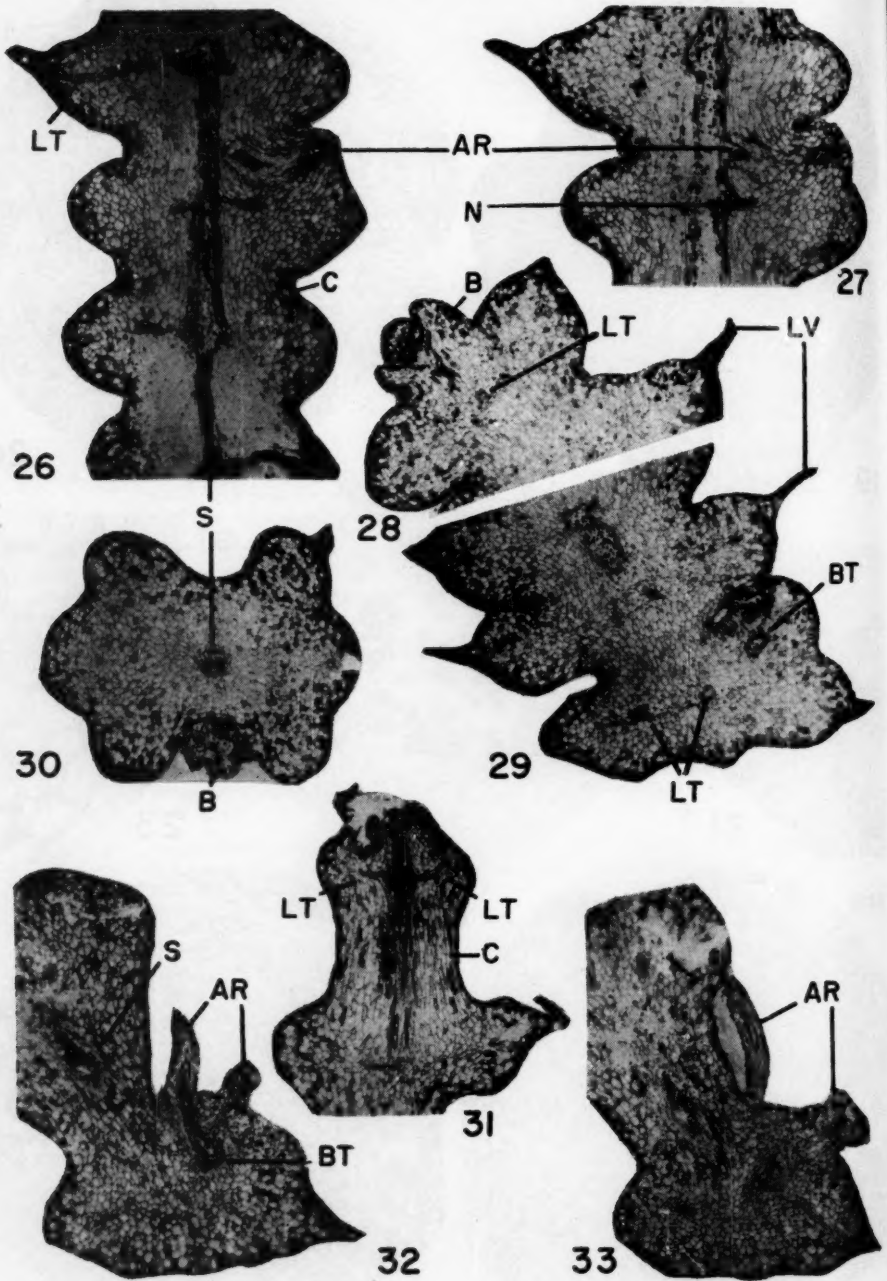
MR



24



PHILLIPS—SPENOPHYLLUM CONSTRICTUM



PHILLIPS—SPHENOPHYLLUM CONSTRICTUM

EXPLANATION OF PLATE

PLATE 4

Sphenophyllum constrictum sp. nov.

- Figure 26. Longitudinal section of stem showing four nodes with one leaf, upper left. LT, leaf trace; AR, adventitious root; C, small chamber separated by one cell from the epidermis; S, unpreserved stelar area, from Kansas.
Slide 2761 $\times 10$ III
- Figure 27. Longitudinal section in serial sequence of stem in fig. 26. AR, adventitious root shown in cauline vascular connection internodally above N, node.
Slide 2764 $\times 10$ III
- Figure 28. Oblique longitudinal section of young stem passing longitudinally through B, nascent branch directly above LT, leaf trace. LV, leaf. See fig. 24 for enlargement.
Slide 2659 $\times 10$ I
- Figure 29. Oblique longitudinal section of young stem passing obliquely through a young branch. LV, leaf; LT, leaf traces; BT, branch trace.
Slide 2675 $\times 10$ I
- Figure 30. Oblique transverse section of young stem. S, stelar area; B, bud.
Slide 2688 $\times 10$ I
- Figure 31. Longitudinal section of a young branch with apex. LT, leaf traces; C, elongated cortical tissue.
Slide 2855 $\times 10$ V
- Figure 32. Oblique longitudinal section of mature stem. S, stele of main axis; AR, two adventitious roots emanating from BT, branch trace.
Slide 2910 $\times 10$ VIII
- Figure 33. Serial peel sequence of fig. 32. Two adventitious roots departing from branch, one on right bifurcating, note leaf trace below.
Slide 2909 $\times 10$ VIII



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SUSTAINED TREATMENT WITH GIBBERELIC ACID OF FIVE DIFFERENT KINDS OF MAIZE*

NORTON H. NICKERSON**

Profound morphological and physiological responses can be induced in many plants by application of the fungal metabolite gibberellic acid (hereinafter called GA). The history of GA has been summarized by Stowe and Yamaki (1957). They indicated that early Japanese work involving *Zea Mays* was performed with extracts prepared directly from cultures of the fungus *Gibberella fujikuroi* (Saw.) Wr. which had been isolated from rice plants, and was mainly concerned with effects on stem elongation. The fungus itself they cited as being reported on maize; indeed, the first valid description of its imperfect stage, designated *Fusarium moniliforme* Sheld., was made from infected maize. Morphological effects noted in these early reports were not consistent; artificial infections of maize with the fungus apparently caused overgrowth, while natural infections did not.

Applications of crystalline giberellins to intact maize plants have been reported by few workers. Marth et al. (1956) reported that treated maize responded with an increase in height, but that the effect diminished with time after treatment was stopped. Phinney (1956) was able to obtain a height increase in four genetically recessive dwarfs of maize by continued application to the plants of small amounts of GA every 3-4 days. He stated that a total of 60 micrograms was enough to cause a genetic dwarf (*dwarf-1*) plant to attain the same height as normal controls, and that this same dosage had no effect on genetically normal plants. Normal plants would, however, respond to increased doses by increase in height. Response of dwarf maize plants has been interpreted as an instance in higher plants where a gene defect in a stepwise series of biochemical reactions is overcome by the addition of GA (Brian and Grove, 1957).

Langridge (1955) interpreted in the same manner his finding that a simple mutant of *Arabidopsis thaliana* responded to thiamine to give normal growth. The response of dwarf *Lolium* to GA is another instance of this same phenomenon (Cooper, 1958). This explanation has not been deemed adequate, however, to explain the overcoming of dwarfness in peas, where several genes are involved (Brian, 1957, 1959). Moreover, other work with maize, reported elsewhere (Nickerson, 1959, in press) shows that GA effectively overcomes the characteristics of two dominant maize mutants, Teopod (*Te*) and Corn-grass (*Cg*), rendering these genetic forms essentially normal in appearance.

Nelson and Rossman (1958) and Wittwer and Bukovac (1958) reported upon a hitherto unknown effect of GA. Male sterility was caused by treatment of normal sweet corn and inbred dent lines (R53 and OH51) when tassels were, according to the first authors, 1" long and according to the second authors, 4-6 cm. long.

* This work was part of a research program carried out during the summer of 1958, while the author held a National Science Foundation Science Faculty Fellowship.

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Results reported below independently verify this effect of treatment with GA.

No study of the effects of various concentrations of GA on the external morphology of different kinds of corn grown under the same conditions exists. During the winter of 1956-57, a small pilot project was carried out on 64 plants of the sweet corn hybrid *Spanscross* in the greenhouse of the Department of Botany, Cornell University, Ithaca, N. Y. Results obtained from treated plants were quite startling; tassel branches were not formed, ears were suppressed, tillers did not develop, and pistillate florets which formed viable caryopses developed in male-sterile tassels of plants which, compared to controls, averaged 50% taller. However, because of results reported by Schaffner (1927, 1930) on sex reversal in maize tassels under short days, of pictures of Singleton's (1946) normal greenhouse-grown plants which clearly show silks in the tassel, and of results noted by Went (1957), where the same induction of pistillate growth was obtained in tassels of plants grown at relatively low temperatures, a more comprehensive experiment under field conditions seemed warranted.

Materials and Methods:

Five kinds of maize were employed in this study. Two were representatives of the well-defined races (for discussion of the race concept in maize, see Anderson and Cutler, 1942) Northern Flint and Zapalote Chico. Parker's Flint was one of the Northern Flints studied by Brown and Anderson (1947); it was chosen because it was well adapted to the area in which the plants were to be grown. Zapalote Chico, studied by Wellhausen et al. (1951, 1952) was chosen because it was an extremely vigorous day-length-independent Mexican dent corn of different morphological type than most U. S. maize. Two other kinds were the inbreds Wisconsin CC5 and L317, chosen because of their widespread use by E. G. Anderson and others as standards in genetic studies (Nickerson and Dale, 1955). The fifth type was *Spanscross*, the hybrid sweet corn mentioned above. Its pedigree and field behavior are well known (Enzie, 1943; Singleton, 1948).

Five plots of each kind of maize¹ were planted in a randomized field of twenty-five plots. Plots were four feet apart each way; the ten plants in each of the five rows of each plot were 20 inches apart each way. All plants in any one row of each plot were subjected to the same treatment. The distribution of treatments within each plot was also randomized. Five treatments were employed:

- 1 — distilled water (controls)
- 2 — distilled water with 5 ppm GA
- 3 — distilled water with 25 ppm GA
- 4 — distilled water with 125 ppm GA
- 5 — distilled water with 625 ppm GA

¹ Grateful acknowledgement is made to the following individuals for their cooperation in supplying seed: Dr. Wm. L. Brown, Pioneer Hi-Bred Corn Co., Johnston, Iowa, for Parker's Flint and CC5; Dr. Willis Skrdla, Plant Introduction Station, Iowa State Colleges, Ames, Iowa, for Zapalote Chico (P. I. 217413); Professor A. A. Johnson, Dept. of Plant Breeding, Cornell University, Ithaca, N. Y., for L317. *Spanscross* seed was purchased from GLF Seed Store, Ithaca, New York.

Every three days one ml. of the appropriate solution, which contained the above-listed concentration as micrograms of GA, was applied from a pipette into the apical leaf cavity of each of the 1250 plants used. The solutions were freshly made each week, and kept in darkness at 19° C.² To eliminate any possible effect of interaction between insecticides, fungicides and GA, no spraying was done either for fungi, of which none was noted, or for insects, of which both corn earworm and corn borer were noted. Fertilizer (Agrico 5-10-10) was applied at the rate of 600 lbs. per acre three and six weeks after germination. Planting date was June 8, 1958; treatments began June 24 and continued until tassel emergence (Table 1).

TABLE 1

TOTAL AMOUNT OF GA RECEIVED BY EACH PLANT IN MICROGRAMS

	No. of Treatments	Amount of GA per treatment				
		0	5	25	125	625
Spancross	12	0	60	300	1500	7500
Parker's Flint	14	0	70	350	1750	8750
Zapalote Chico	17	0	85	425	2125	10625
CC5	19	0	95	475	2375	11875
L317	19	0	95	475	2375	11875

Results:

No differences in response were noted among each of the five plots of any one kind of maize. Agreement was very close as to height of plants, internode lengths, numbers of tassel branches, ears and tillers, rapidity of effects of GA, and effects noted at each concentration employed. The results are therefore attributed directly to the treatment given rather than to any environmental variation. In determining average effects (Tables 2-6), all plants of one kind which received a particular treatment were included, regardless of location in the field. Wind damage was due to brittleness of treated plants; to assure some survivors, as many as possible, beginning with the plants receiving the highest concentrations and working down, were staked and tied. These lines are noticeable on some of the figures (Plates 6-10).

² The GA employed was kindly supplied by Dr. Curt Leben, Argicultural Research Division, Eli Lilly and Co., Greenfield, Indiana.

Hybrid Spancross. (Tables 1, 2; Fig. 1, Plate 6). Treatments with 25 ppm were most effective in promoting stem elongation; higher concentrations induced poor overall vegetative growth and reduced ear and tiller formation. Adventitious brace or prop roots were formed only on the two lower nodes of controls, but they appeared at all nodes below the ear on plants given GA. Tassel branch reduction was linearly related to increased concentrations. Male sterility and development of pistillate florets also increased with increased concentrations. The terminal inflorescences produced, having few or no primary branches, pistillate spikelets below and staminate spikelets above, greatly resembled those of *Tripsacum-Zea* hybrids (Mangelsdorf and Reeves, 1939; see their figure 31.). Rachises in these treated tassels may be disarticulated into segments in the same manner as those of *Tripsacum* inflorescences. Spikelets, however, are in pairs, and may be either both pistillate (as in several tassel-seed mutants) or the member of a pair may be pistillate and the pedicellate staminate (as in Tassel-seed 3; Nickerson & Dale, 1955). Cupules (Nickerson, 1954; Galinat, 1956) were developed in both instances. Worm damage was general in ears and some tassels; damaged plants were excluded from Table 2 below. Ears of controls and the first two concentrations were apparently identical; those from 125 ppm plants were smaller than control ears. Ears from 625 ppm plants were small, with aborted apices, and resembling strawberry pop ears in shape.

Parker's Flint. (Tables 1, 3; Fig. 1; Plates 5, 7). The 25 ppm treatment was most effective in promoting stem elongation and development of basal internodes. This effect extended to tassel branches which were $\frac{1}{4}$ to $\frac{1}{2}$ again as long as those of controls. Brace roots appeared as far as 30 cm. above ground on the lower 3-4 nodes of treated plants; controls showed brace root development on only the two lowest nodes. Average tiller number, ear number and tassel branch number decreased with increasing treatment. Male sterility was more prominent than development of female spikelets, but the latter did occur. The two higher treatments tended to produce thin spindly plants with long, narrow, often rolled leaves; many plants were rejected because of failure to extrude tassels. Dissections of these plants revealed only rudiments of tassels present. The 125 ppm treatment seemed to be more detrimental to growth than the 625 ppm treatment. Worm damage, especially to ears, was most extensive in this group. Ears of controls and of the first two treatments were alike in appearance. Ears of 125 ppm plants were about half the size of controls. Ears of 625 ppm plants did not mature. Tillers (axillary shoots) were apparently induced to develop after unintentional decapitation by wind breakage occurred on plants receiving higher treatments. This effect of axillary suppression in intact plants and stimulation in decapitated ones was noted in peas by Brian et al. (1955) and Brian (1957). This same phenomenon occurred also in three other types listed below, all normally tillerless.

Zapalote Chico. (Tables 1, 4; Fig. 1; Plate 8). The 125 ppm treatment was most effective in promoting stem elongation; an average height nearly double that of controls was noted. The greatest number of nodes was likewise formed under this

treatment. All extra nodes were below the point of attachment of the ear. Brace roots appeared in controls and on 5 ppm plants on the two lowermost nodes. All other treated plants developed brace roots on the lower 4-6 nodes, at distances as high as 70-100 cm. above the ground. Width of leaves was reduced to 3-4 cm., while controls had leaves 6-9 cm. wide. Average number of ears and tassel branch number decreased, while male sterility and pistillate spikelet development increased with increasing treatment strength. Damage from wind was high in the tall plants, where internodal diameters averaged less than 1 cm. compared to 2.5-3.5 cm. of controls. This maize was the most vigorous of the five types here considered; plants formed excellent ears and tassels completely free from worm damage. Most exclusions in this group resulted from non-exsertion of tassels and failure of tassels to develop anything more than primordia of branches and florets. Most of these latter ones were pistillate, but had neither cupules nor functional parts. Ears of controls and of the first two treatments were alike in appearance. Ears of 125 ppm plants were reduced in size and in fertility; few caryopses formed. Ears of 625 ppm plants did not mature.

Inbred CC5. (Tables 1, 5; Fig. 1; Plate 9). No significant increase in height with increasing dosage was noted. Plants normally do not form tillers, and did not with treatment. Brace roots were formed at the lowest two nodes on controls, at the lowest 3-4 nodes with 5 ppm treatment and at the lowest 4-7 nodes with 25 ppm treatment. Ear number and tassel branch number decreased with increasing concentration; male sterility was significant at the 25 ppm treatment and pistillate development was marked in the few plants surviving the higher treatments. At a treatment of 125 ppm, plants were twisted and swollen at the nodes; nearly 70% of them were killed by the tenth to twelfth treatment. Of those surviving, most failed to exert a tassel. The same effect, only more pronounced (90% kill), occurred with 625 ppm plants. A few plants in both 25 ppm and 125 ppm groups gave no visible response to the treatment. Aside from modified tassels, these survivors resembled the controls. Rejected plants generally did not exert tassels; when these were dissected and examined, they were found to be composed of pistillate rudiments and were apparently male sterile. Ears were alike in appearance in controls and with 5 ppm and 25 ppm treatments. No ears were matured at higher concentrations.

Inbred L317. (Tables 1, 6; Fig. 1; Plates 5, 10). Response in height was greatest at the lowest treatment of 5 ppm. Vegetative growth was affected above that point, with higher treatments increasingly effective in producing twisted and contorted plants which generally died. Plants did not form tillers on either controls or test plants. Brace roots were formed at the lowest 1 or 2 nodes of controls and at the lowest three nodes in both 5 ppm and 25 ppm treatments. Male sterility and pistillate development increased with higher concentrations. The same situation mentioned above occurred here also; two plants out of 50 given the 625 ppm treatment did not die but became about 20% taller than the controls. Rejected plants generally did not exert tassels. Upon dissection, these tassels were found

to be rudimentary, mostly pistillate, and apparently male sterile. Ears were alike in controls and 5 ppm plants, but did not mature at higher concentrations.

Discussion and Conclusions:

GA causes marked response in stem elongation, but its effect is dependent both upon the race of maize studied and the concentration of GA employed. Total height is in itself a nebulous measure of elongation effects in GA-treated plants. Internode diagrams (Anderson and Schregardus, 1944) provide a means for more direct comprehension of just where growth is increased. Brian et al. (1958) maintained that GA did not delay maturation of pea internodes but rather matured them early. They reported that the rate of extension was speeded up. The same may be true in maize, because internodes did not elongate indefinitely. Plate 1 shows that the elongation was extremely rapid. Internode diagrams were constructed whenever possible for five plants of each of the treated groups of each maize type. One representative diagram of each group is shown in Fig. 1. These were constructed from the tassel down, hence the internodes were drawn in the inverse order of their appearance, and tassels are at the same relative position on each graph.

The top row represents controls in each maize type. Spancross and Parker's Flint essentially exhibit increasing internode lengths from base to top of plant. Zapalote Chico reaches a maximum below the ear then shows a succession of shorter internodes up to the peduncle, the internode just below the tassel. CC5 has a slightly modified Parker's Flint curve; L317 has gradually elongating internodes up to the ear, then shortening internodes to the tassel. A vertical comparison of diagrams in each column will show what concentrations affected which internodes within one kind of maize; horizontal comparisons will show how the various maizes responded to the same concentration of GA.

In Spancross, 5 ppm gave an increase in all internodes except the lowest and highest. With 25 ppm, greater elongation occurred in the internodes below the ear compared with controls. This trend was accentuated by the 125 ppm and 625 ppm concentrations. With the latter concentration, internode elongation above the ear fell off drastically, with a slight recovery noted in the peduncle.

In Parker's Flint, the 5 ppm and 25 ppm concentrations caused general increase in all internode lengths. Extra internodes were apparently formed under all treatments, always below ears. Brian (1957) reported that GA had no effect on internode number in peas. In maize, these extra internodes were found not to be expansions of normally short internodes at the base of the plant, but new ones added in between the established base of the plant and the node bearing the ear, apparently before differentiation by the meristem of tassel and ear primordia. 125 ppm on Parker's Flint caused a rapid decline in vegetative growth after initial rapid and extreme elongation. With 625 ppm, the plants exhibited three peaks of elongation; one early, one associated with the ear node and one associated with the peduncle.

In Zapalote Chico, nodes below the ear were stimulated with 5 ppm. With 25 ppm, this stimulation was more marked; an early peak was followed by decreases in length up to the ear node, after which the same pattern already noted took place. The 125 ppm treatment produced marked early elongation, followed by a gradual dropping in length of most subsequent internodes and a slight upturn associated with the peduncle. 625 ppm produced the greatest initial elongation, but after a peak the drop in rate was rapid, again with a slight upturn associated with the peduncle.

In CC5, 5 ppm and 25 ppm caused marked elongation of early internodes, but this effect did not persist. Both above and below the ear node, variations seen in the successive lengths of control internodes were accentuated. The 125 ppm concentration, which only 4 plants survived, showed extensive early elongation followed by a steady decline.

In L317, lower internodes were stimulated only slightly by 5 ppm, while internodes *above* the ear increased in length along the same pattern as controls. At 25 ppm, the four internodes *below* the ear showed most elongation; the lowest internodes were apparently inhibited by GA.

The greatest elongations were not obtained under poor growing conditions, which Applegate (1958) and Wittwer and Bukovac (1958) noted were apparently best for maximum expression of the potentialities of GA. The plants in this experiment had soil moisture and temperatures optimum for maize growth when the effects noted above were being manifested. In summary, the same internodes of one kind of maize reacted differently but characteristically to each of the concentrations of GA employed. When homologous internodes of two kinds of maize are compared, their reaction to a particular concentration of GA was also different but characteristic for each maize.

The higher concentrations of GA tended to weaken plants, reduce growth in length, cause swelling at nodes, twisting of culms, poor leaf blade development (rolled, narrow and with various degrees of chlorosis), and brittle leaf sheaths which often separated from the culms. Inbreds responded most drastically to these concentrations and were either killed or greatly reduced in size; the hybrid was least affected. Survival of a few inbreds among populations which were essentially wiped out by certain treatments probably indicates a history of non-selection for physiological variability within morphologically constant plants.

The inflorescences developed by treated Spangcross plants may be of some importance to students of maize history, because large-glumed strawberry-like ears (with, in this case, full-sized kernels) and unbranched or slightly branched terminal inflorescences with pistillate parts below and staminate parts above are close to what Mangelsdorf (1954) has postulated as a forerunner of today's corn. The articulation of the rachis of this artificially-produced inflorescence into joints containing one pair of spikelets in the same manner as wild grasses like *Tripsacum* is of further significance. One interpretation of these observations is that GA allows genes suppressed by modifying factors to become expressed. Cases of re-

version from adult to juvenile foliage by treatment with GA in *Poa pratensis* (Leben and Barton, 1957) and in *Hedera* (Robbins, 1957) and of a prolonging of the juvenile leaf form in *Ipomoea* (Njoku, 1958) and peas (Barber et al., 1958) are possibly subject to a like interpretation. The concentration of GA employed may be of significance, for relatively small amounts applied to seedlings of *Eucalyptus* were reported to bring about early development of adult foliage (Scurfield and Moore, 1958). Evolution may involve not only specific mutation of genes for particular characters from one state to another, but also a superimposing of modifications on their expression which leaves the original genes still present and basically unchanged.

In general, GA reduces branching relationships in intact maize plants, restricting formation of ears, tillers and tassel branches in inverse proportion to the concentration employed. As mentioned above, tiller formation was enhanced on decapitated plants, an observation also in line with the findings of others (Brian, 1957). Production of pistillate or mixed staminate-pistillate spikelet pairs in the tassel essentially duplicates some of the effects attributed to a recessive gene (Tassel-seed 1 or ts_1) and a dominant gene (Tassel-seed 3 or Ts_3). Significantly, ear production in both these genetic forms and the GA-produced ones is reduced (Nickerson and Dale, 1955). The development of pistillate spikelets is not too surprising, for Weatherwax (1916) pointed out the fact that all florets of maize are potentially perfect.

Brace root formation was enhanced by several different concentrations of GA applied at points well away from their areas of emergence on the plants. Their stimulation by GA agrees with the report by Whaley and Kephart (1957) who found that in culture, maize root stimulation was a function of the GA concentration. Robbins (1958) also reported stimulation of maize root growth in culture, but at relatively low concentrations of GA. Stowe and Yamaki (1957) presented conflicting evidence. Brian (1959) stated that root growth of intact plants is not known to be stimulated by GA. On the basis of the observations noted above, it seems reasonable to conclude that adventitious root formation can be stimulated by GA in grasses, with effects depending upon concentrations and the plant involved.

The induction of male sterility by GA may well have a use in hybrid corn breeding, as Nelson and Rossman (1958) pointed out. In the plants described earlier, male sterility was brought about by failure of stamens to form. Glumes, lemmas and paleas were generally formed; tassels resembled those of the recessive mutant tassel-seed 8 (ts_8) (Nickerson and Dale, 1955). Tips of branches and of central spikes on many treated plants were often sterile, even when pollen-shedding stamens occurred in the proximal parts of tassels. The effect was more pronounced with increased concentrations of GA.

These results indicate that GA is a powerful aid to morphological study in that it can cause expression of normally undeveloped plant parts and modification of basic plant structures. It further shows that consistent treatments produce consistent results, and suggests that these modified forms may be relied upon to contribute valid data to problems of plant structure.

Summary:

One hybrid, two inbreds and representatives of two exotic kinds of maize were subjected to four different concentrations of Gibberellic Acid throughout the growing season. Internode diagrams of controls and treated plants demonstrated that the increase in height which was generally observed took place neither in the same nodes for different kinds of maize nor to the same extent for particular nodes of one kind of maize subjected to different GA concentrations. A general reduction of branching occurred in all cases. High concentrations of GA inhibited vegetative growth, eventually killing some plants. The hybrid was least changed; inbreds were profoundly modified. Male sterility and pistillate florets in tassels which resembled certain dominant and recessive mutants were obtained in all groups. One group produced terminal inflorescences which in their organization and manner of articulation strongly resembled terminal inflorescences of *Tripsacum*. Brace root formation was stimulated with increased concentrations of GA.

The author wishes to thank Dr. Edgar Anderson for his critical review of the manuscript and Mr. M. V. S. Raju for his preparation of Figure 1.

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TABLE 2 — HYBRID SPANCROSS

Treatment in ppm of GA		0	5	25	125	625
Averages of all available plants (maximum number, 50 per column)	Height (Av. of 5 plants to nearest cm.)	89	103	136	106	84
	Number of Nodes (Av. of 5 plants)	8	8	8.6	8.8	8.4
	Number of Tillers	1.8	0.8	0.2	0.0	0.0
	Number of Ears	1.8	2.0	1.6	1.1	0.7
	Number of Primary Tassel Branches	3.2	2.0	2.0	1.7	1.5
	Percent of Tassels wholly Male Sterile	0	0	8.8	67	95
	Percent of Tassels with Functional Pistillate Florets	0	8	20	72	95
	Number of Plants Dying From Treatment	0	0	1	0	5
	Number of Plants Broken by Wind	0	3	4	1	7
	Number of Plants Excluded	5	11	11	10	12

TABLE 3—PARKER'S FLINT

Treatment in ppm of GA		0	5	25	125	625
Averages of all available plants (maximum number, 50 per column)	Height (Av. of 5 plants to nearest cm.)	162	136	180	113	174
	Number of Nodes (Av. of 5 plants)	8	8.8	10.2	8.8	9.6
	Number of Tillers	2.9	2.2	0.7	0.2	0
	Number of Ears	2.1	1.8	1.7	0.6	0.4
	Number of Primary Tassel Branches	9.8	9	8	5	5
	Percent of Tassels wholly Male Sterile	0	0	3	79	96
Plants discarded per group of 50	Percent of Tassels with Functional Pistillate Florets	0	0	0	16	46
	Number of Plants Dying From Treatment	0	0	1	3	4
	Number of Plants Broken by Wind	0	2	6	11	9
	Number of Plants Excluded	0	2	8	17	13

TABLE 4—ZAPALOTE CHICO

Treatment in ppm of GA		0	5	25	125	625
Averages of all available plants (maximum number, 50 per column)	Height (Av. of 5 plants to nearest cm.)	169	186	198	248	202
	Number of Nodes (Av. of 5 plants)	11.2	12.2	13.4	14.2	13.6
	Number of Tillers	0	0	0	0	0
	Number of Ears	1.4	1.4	0.8	0.8	0.1
	Number of Primary Tassel Branches	20.6	17.8	14.7	15.9	8.8
	Percent of Tassels wholly Male Sterile	0	0	0	38	79
Plants discarded per group of 50	Percent of Tassels with Functional Pistillate Florets	0	0	0	3	63
	Number of Plants Dying From Treatment	0	0	0	1	8
	Number of Plants Broken by Wind	0	0	13	11	7
	Number of Plants Excluded	0	0	4	9	16

TABLE 5 — INBRED CC5

Treatment in ppm of GA		0	3	25	125	625
	Height (Av. of 5 plants to nearest cm.)	150	141	162	Insuff. No. of plants	Insuff. No. of plants
	Number of Nodes (Av. of 5 plants)	12.4	12.6	12.6	Insuff. No. of plants	Insuff. No. of plants
	Number of Tillers	0	0	0	0	0
	Number of Ears	1.8	1.5	0.7	0	0
	Number of Primary Tassel Branches	6.7	4.6	5.0	5.2	0
Averages of all available plants (maximum number, 50 per column)	Percent of Tassels wholly Male Sterile	0	0	80	100	0
	Percent of Tassels with Functional Pistillate Florets	0	0	7	100	0
	Number of Plants Dying From Treatment	0	3	8	34	45
	Number of Plants Broken by Wind	1	5	12	2	0
	Number of Plants Excluded	1	3	15	10	5

TABLE 6 — INBRED L317

Treatment in ppm of GA		0	5	25	125	625
	Height (Av. of 5 plants to nearest cm.)	154	161	144	Insuff. No. of plants	Insuff. No. of plants
	Number of Nodes (Av. of 5 plants)	13.4	13.2	13.0	Insuff. No. of plants	Insuff. No. of plants
	Number of Tillers	0	0	0	0	0
	Number of Ears	1.3	1.1	0.5	0	0
	Number of Primary Tassel Branches	9.1	5.9	4.4	0	8.5
Averages of all available plants (maximum number, 50 per column)	Percent of Tassels wholly Male Sterile	0	0	32	100	100
	Percent of Tassels with Functional Pistillate Florets	0	0	12	100	100
	Number of Plants Dying From Treatment	0	5	8	41	39
	Number of Plants Broken by Wind	0	1	4	0	1
	Number of Plants Excluded	7	5	17	7	8

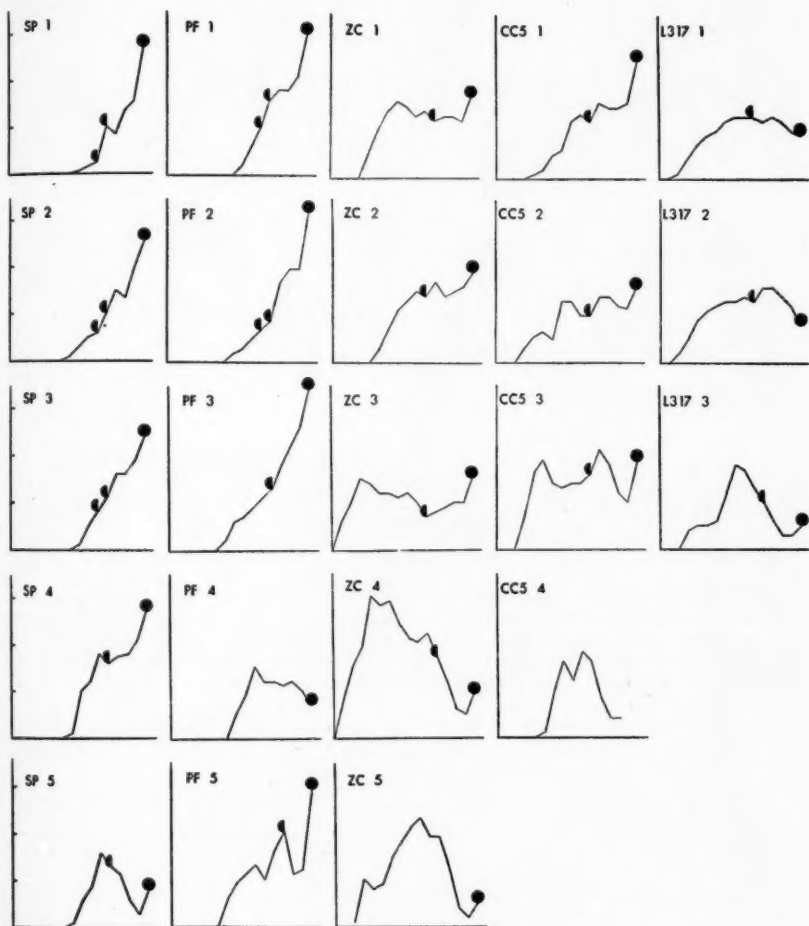


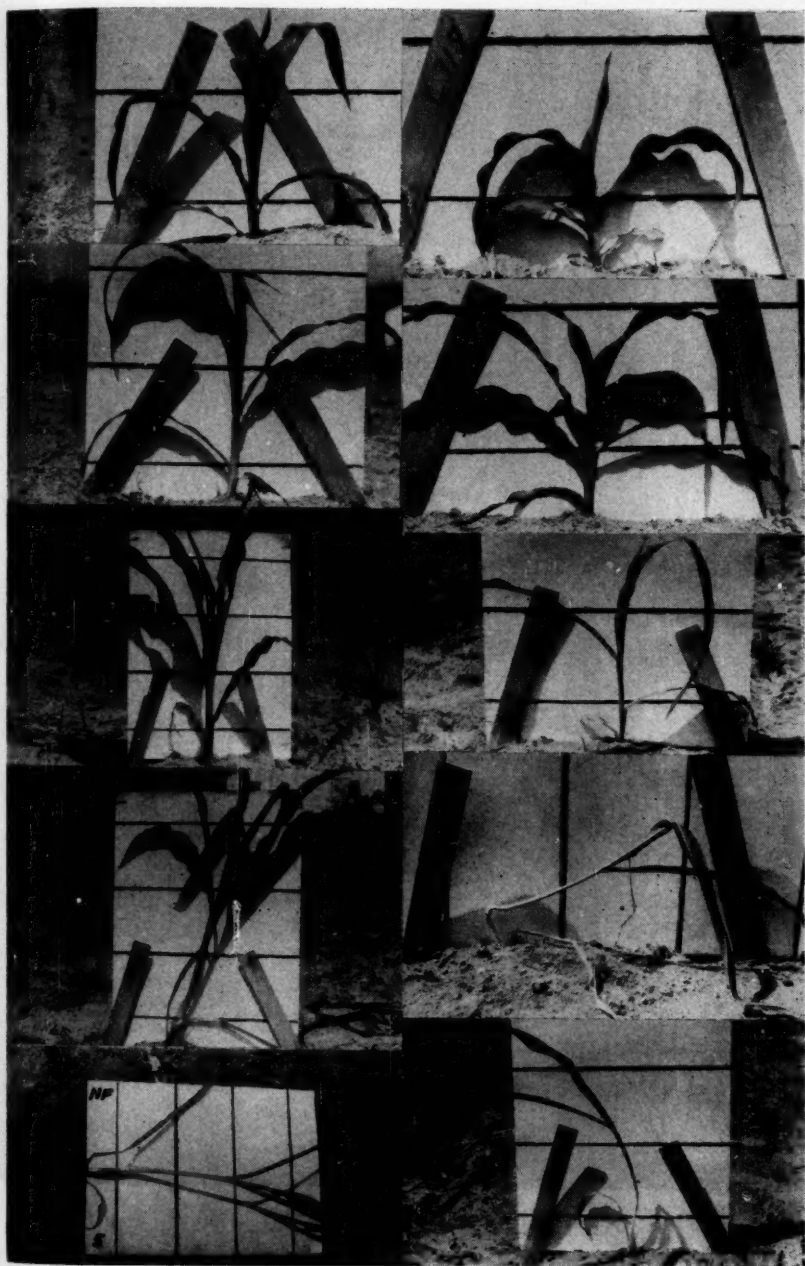
Fig. 1. Internode Diagrams of control (top row) and GA-treated maize plants. Horizontal axis is internode number. Vertical axis is internode length in cm.; each division is 10 cm. Circle denotes tassel; semicircle denotes ear.

Sp, Spancross; PF, Parker's Flint; ZC, Zapalote Chico; CC5 and L317 are standard inbred lines. Number 1 stands for distilled water (controls); 2 for 5 ppm GA; 3 for 25 ppm GA; 4 for 125 ppm GA; 5 for 625 ppm GA. Further explanation in the text.

EXPLANATION OF PLATE

PLATE 5

Plants of Parkers (Northern) Flint and L317 four and one-half weeks after planting and after six consecutive treatments every three days with GA. Lines on background are 10 cm. apart. Note characteristic elongate and angled growth at higher concentrations. Numbers refer to concentration of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Further explanation in the text.



NICKERSON—TREATMENT WITH GIBBERELIC ACID



NICKERSON—TREATMENT WITH GIBBERELIC ACID

EXPLANATION OF PLATE

PLATE 6

Mature plants of Spancross from each GA treatment. Lower right-hand figure shows *Tripsacum*-like tassel common in plants receiving 125 ppm of GA. Numbers refer to concentrations of GA employed as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

EXPLANATION OF PLATE

PLATE 7

Mature plants of Parker's (Northern) Flint from each GA treatment. Lower right-hand figure shows male-sterile tassel commonly developed at higher concentrations of GA. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.



NICKERSON—TREATMENT WITH GIBBERELIC ACID



NICKERSON—TREATMENT WITH GIBBERELIC ACID

EXPLANATION OF PLATE

PLATE 8

Mature plants of Zapalote Chico from each GA treatment. Lower right-hand figure shows sterile tassel with rudimentary pistillate parts. Tassel was borne turned 90° , so silks hung down. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

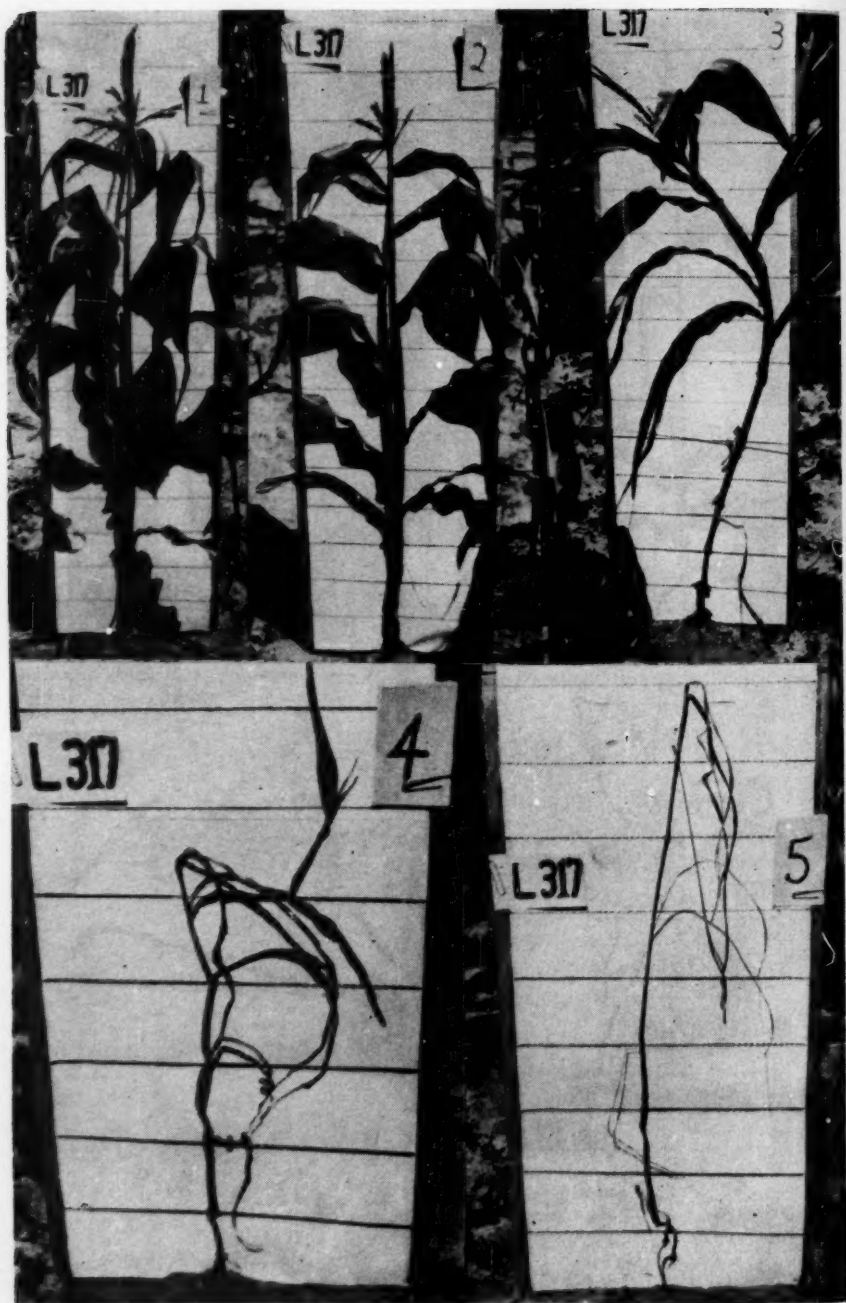
EXPLANATION OF PLATE

PLATE 9

Mature plants of Inbred CC5 from each GA treatment. None survived treatment 5. Lower right-hand figure shows detail of strongly pistillate tassel developed by a few plants receiving treatment 4. Numbers refer to concentrations of GA employed as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm; Lines on background are 10 cm. apart. Further explanation in the text.



NICKERSON—TREATMENT WITH GIBBERELIC ACID



NICKERSON—TREATMENT WITH GIBBERELIC ACID

EXPLANATION OF PLATE

PLATE 10

Mature plants of Inbred L317 from each GA treatment. Few plants survived treatments 4 and 5. Numbers refer to concentrations of GA employed, as follows: 1, distilled water; 2, 5 ppm; 3, 25 ppm; 4, 125 ppm; 5, 625 ppm. Lines on background are 10 cm. apart. Further explanation in the text.

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SOME LICHENS OF TROPICAL AFRICA. III. PARMELIACEAE¹

CARROLL W. DODGE

Since the publication of Part II² I have continued to receive specimens for study from the Royal Botanic Gardens at Kew, the East African Herbarium at Nairobi and the Farlow Herbarium of Harvard University, through the kindness of their directors and curators, as well as smaller collections from F. C. Deighton (Sierra Leone) and C. A. Thorold (Nigeria). Among the collections from Kew was one from Ethiopia, gathered by undergraduates of Cambridge University (C.B.E.E.)³ in the summer of 1957, which was very useful in interpreting several species of which I had seen only very old collections. The director of the Conservatoire Botanique de Genève sent a small collection from the Côte d'Ivoire, collected by Guy Roberty; Professor Edna M. Lind of Makerere College sent a small collection from Kenya and Uganda, collected by A. Burnet; and Mr. Oliver Kerfoot of the East African Agriculture and Forestry Organisation sent his collections from Kenya. I wish to thank all who have supplied specimens for this study. I also wish to express thanks for collections of the late G. M. Allen, of the Museum of Comparative Zoology of Harvard University, given me by the late R. H. Howe, Jr., and Kenya specimens given me many years ago by Mrs. Anita Grosvenor Curtis. The late D. H. Linder gave me a few specimens from his collections while with the Harvard Institute of Tropical Biology and Medicine Expedition 1926-27.

Since many specimens came from the Union of South Africa, Madagascar and Mauritius, I have included in this study all species from regions south of 15° N. latitude. In interpreting handwriting on labels, I have used the gazetteers of the U. S. Board on Geographic Names for British East Africa; Rhodesia and Nyasaland; Angola; and Madagascar, Réunion and the Comoro Islands, as well as the recent Times Atlas for other regions.

METHODS

Care has been taken to secure longitudinal sections of the marginal lobes of the thallus, perpendicular to the tip or margin. Since the thallus is usually thinner at the margin than near the center, the thickness of the medulla is recorded as less than that of writers who prepared sections from the central portion of the thallus. If transverse sections are cut, the ends of closely woven longitudinal hyphae will appear pseudoparenchymatous in the medulla and lower cortex. In many cases owing to scanty material, sections of the apothecium have been cut perpendicular to the thecium and where feasible, radial, i.e. perpendicular to the apothecial

¹ Issued June 17, 1959.

² Some lichens of tropical Africa. II. *Usnea*. *Ann. Missouri Bot. Gard.* 43:381-396. 1956, 44:1-76. 1957.

³ The party consisted of the following with their colleges: W. J. Ballantine (Downing), I. M. Evans (Magdalen), J. R. Flenley (Clare), R. G. Hiller (Christ's), C. L. A. Leakey (King's) and J. N. Lythgoe (Trinity). I did not receive locality data on their collections of July 25, 1957, probably along the route from Addis Ababa to the Chokke Mountains.

margin. Colors of the thallus and disc, unless otherwise stated, have been recorded for the dry material. Ridgway's *Color Standards and Color Nomenclature*, 1912, has been used. It is less satisfactory for the Parmeliaceae as many thalli are intermediate between wood brown and olive buff.

Both Phloxine in glycerol and acid fuchsin in Amman's lactophenol have been used as a combined stain and mounting medium. Apparently there is sometimes a reaction between the granules (or very minute crystals) and the lactophenol, especially in the medulla, since the medulla of sections floating in water appears uniformly white or grayish under low magnification, while after staining, brownish granules appear in the medulla. Brownish granules may also result from slow oxidation in the herbarium, often seen in specimens more than a century old

MORPHOLOGY

Thallus. Branching of lobes is probably dichotomous throughout the family, but is often very irregularly so, i.e. one branch is often somewhat wider. In narrow lobes with short internodes, the branching often appears subpinnate to pinnate. In *Parmelia* subg. *Amphigymnia*, the thallus is more completely monophyllous, margins of short rounded lobes and branching is rarely seen.

Cilia. When present, cilia are characteristic of a species and may be close or distant, usually rarer or nearly absent on sorediate lobes. They are usually best seen on the peripheral lobes, as they are rarely confined to central lobes. They are extremely rare but characteristic when present on the margin and exciple of the apothecium. They are extremely rare and never characteristic on the upper surface of the thallus in our area (except in *Omphalodium*). In a few species of *Parmelia* sect. *Hypotrachyna*, the rhizinae from the underside are quite long and bend outward so that they show beyond the margins of the lobes, and if dense may form a pseudo-hypothallus. At first sight they may be mistaken for short marginal cilia.

Underside. In a few species, the underside is pale and the rhizinae also pale, often translucent. Usually the underside is black or dark fuscous, shading to chestnut or fuscous on the marginal lobes. An abrupt change from black to cream buff on marginal lobes seems due to local environment and seldom affects all lobes of a thallus. This condition is more often seen beneath lobes with sorediate margins. When it occurs quite regularly on one species and not at all on a related species, it is of secondary importance in the separation of species.

Attachment to the substrate. In *Hypogymnia*, rhizinae are completely absent and the thallus is attached to the substrate by stimulation of the cells of the lower cortex to secrete an adhesive gel where in contact with the substrate. If the thallus is removed without long soaking, patches of the lower cortex are torn away, sometimes giving a pseudocyphellate appearance, or if the areas be larger, the appearance of the underside of a *Lobaria*, although the areas are more irregular with more clearly defined borders.

Rhizinae are usually formed by outgrowth of cells of the lower cortex, more rarely from a strand of medullary hyphae corticated by proliferation of cells of the lower cortex. In *Parmelia* subg. *Euparmelia*, the rhizinae are usually quite

dense, slender, simple or more rarely several times dichotomous near the tips, often becoming progressively shorter, passing into papillae toward the margins of the lobes which may be narrowly nude (less than 2 mm. wide) or only slightly verrucose. In a few species of sect. *Xanthoparmelia*, the rhizinae may be very sparse but are always slender and relatively short. In *Parmelia* subg. *Amphigymnia* and in some species of *Pseudevernia*, the rhizinae are stout, either short or long, occurring singly or in small dense clusters ending in a much branched tip forming a disciform holdfast (rarely bulbiform) when the tip makes contact with the substrate. When the tip of the rhizina fails to make contact with the substrate, it is usually much longer with an acute unbranched tip, resembling a cilium.

Gomphus. In *Omphalodium*, a large, central or eccentric gomphus, often up to 10 mm. in diameter, is formed of root-like fibers which penetrate between the crystals of the underlying rock, or between the cells of bark, similar to that found in the Umbilicariaceae. Coarse rhizinae, resembling the cilia, may be present on the underside, but never develop holdfasts. Possibly a gomphus is formed in *Everniopsis* and some species of *Pseudevernia*, but has not been seen as the base is usually torn away in collecting.

Upper cortex. Probably the upper cortex is always fastigiate, usually so highly gelified that only the very slender vertical lumina (protoplasts) may be seen in sections. The terminal cell may be long cylindric, the others short, or the cortex may be pseudoparenchymatous with spherical protoplasts in vertical rows. Very rarely the cortical hyphae are dichotomous above and the protoplasts are more irregularly arranged. In most species the cortex is about 15 μ thick.

Algae. The algae are probably always species of *Trebouxia*, rather than of *Protococcus*, as stated by many former authors. In seven species in which the algae have been isolated in pure culture by Warén, 1920¹ and Jaag 1929, 1933² the algae are definitely *Trebouxia*. The algae are often in discrete colonies, but are sometimes so closely packed that the colonial arrangement is not clear. In a few species where the upper cortex is fastigiate and less gelified, cells or columns of algal cells push up between the cortical hyphae for some distance. Very rarely the algal cells are in vertical rows between branches of medullary hyphae, but not truly filamentous.

Medulla. The medulla is white unless otherwise specified in the descriptions. It is usually formed of very thickwalled longitudinal hyphae, sometimes parallel but not conglutinate (except in *Everniopsis*) more often closely interwoven, sometimes throughout, sometimes in only a portion of the medulla. In some species, the hyphae are loosely woven with large air spaces just under the algal layer. In very fragile species and in most species of *Hypogymnia*, the medullary hyphae are loosely woven to arachnoid, and in some species of *Hypogymnia* hyphae may be absent in the center of the thallus, resulting in hollow lobes. In a few species the

¹ Warén, H. 1920. Reinkulturen von Flechtengonidien. Helsinki. cited by Jaag, 1933.

² Jaag, O. 1929. Recherches experimentales sur les gonidies des lichens appartenant aux genres *Parmelia* et *Cladonia*. Univ. Genève Thèse 804:1-128. pl 1-6.

Jaag, O. 1933. Ueber die Verwendbarkeit der Gonidialalgen in der Flechtensystematik. Ber. Schweiz. Bot. Ges. 42:724-739.

longitudinal hyphae are loosely woven with many oblique hyphae and vertical hyphae connecting the cortices. In general the thickwalled medullary hyphae form the principal mechanical tissue although it is only a sclerotic ribbon in *Everniopsis*.

Lower cortex. The lower cortex is usually of gelified pseudoparenchyma, either fastigiate or from longitudinal hyphae. In the Antarctic *Parmelia* subg. *Physcioidae* (not found in our area) the lower cortex is fibrous rather than pseudoparenchymatous. It is usually dark brown to black throughout, rarely dark only in the outer portion. Sometimes it is reduced to a single layer of cells. In thick sections the cortex appears structureless and carbonaceous. Sections should be longitudinal (i.e. perpendicular to the tip of a lobe) or the lower cortex will appear to be of fastigiate pseudoparenchyma although it may truly be pseudoparenchymatous from longitudinal hyphae.

Apothecium. The disc is usually continuous, but sometimes perforate, especially in *Parmelia* subg. *Amphigymnia*. The amphithelial is similar in structure to that of the thalline upper cortex, but is often much thicker. The algal layer may be better developed than in the thallus, or some algal colonies may die and disintegrate, leaving lacunae which finally may be filled with medullary hyphae, although colonies still persist at the margin. The medulla is similar in structure to that of the thallus but is often more loosely woven with larger air spaces. The thickness of the medulla has not been recorded as it may be very thick near the stipe and very thin, almost disappearing at the margin. The algal layer under the parathecium tends to be thicker and more continuous than that next the amphithelial cortex. In some species this is reversed where the margin remains incurved most of the time.

Parathecium. Usually the parathecium has the same structure as that of the amphithelial cortex and is continuous with it at the margins, but it may be thicker or thinner. Apparently the tissues developing from the ascogonium develop above the cortex. In some species there are suggestions in the arrangement of hypothelial hyphae and paraphyses, either that several or many ascogonia take part in the formation of a compound thecium, or that the periclinal ascogenous hyphae send up short vertical branches which in turn form dense tufts of paraphyses and asci. Not enough very young apothecia have been available to study this question satisfactorily. In one species of sect. *Xanthoparmelia*, one in sect. *Hypotrachyna* and 12 species of the subg. *Amphigymnia*, a true parathecium seems to be absent, being replaced by a pseudo-parathecium formed by partial differentiation of the lower part of the hypothecium into a distinct layer of relatively much thicker-walled pseudoparenchyma from periclinal hyphae with ellipsoid rather than spherical protoplasts, the long axes periclinal. In these species probably the ascogonium develops at the top of the algal layer at the junction with the upper cortex and pushes aside the hyphae of the upper cortex to form the amphithelial cortex. Such very early stages have not been seen in these species. In two species of *Parmelia* subg. *Amphigymnia* the lower part of the parathecium is fastigiate, the upper ends of the hyphae bending outward until the upper portion is periclinal pseudoparenchyma. Rarely the parathecium is reduced to a very thin layer and may be overlooked in thick sections.

Thecium. The thecium is always highly gelified, so that the paraphyses are never free, at least at their tips; their walls are very indistinct. The lumina (protoplasts) are cylindric below, septate, sometimes closely, sometimes sparingly so, about $1\ \mu$ in diameter. Dichotomous branching of the paraphyses is usual above the asci, varying from once to about thrice, the branches sometimes moniliform, the tips often narrowly clavate to subspherical, usually ending below the surface of the brownish epithelial gel, which is very thick in young thecia.

Asci. The asci are normally 8-spored, very rarely less by abortion of 1-4 ascospores, i.e. young asci show cleavage of 8 ascospore initials, although mature asci show only 4-5 ascospores with remnants of the others. The asci are fundamentally all clavate, but just before spore discharge, they may appear cylindric (ascospores monostichous) or ellipsoid (ascospores distichous). The wall is usually thin with a thickened tip when young, but in 13 species the wall is $3\ \mu$ or more thick, ascospores usually with thick episporous resembling minute *Pertusariaceae* asci. The thick wall may thin somewhat as the ascospores mature, but still remaining much thicker than in other families of lichens. The tip may be still thicker, usually with a rounded protoplast (very rarely mamillate), thinning to about the thickness of the rest of the ascus wall as the ascospores mature.

Ascospores. The ascospores are uniformly hyaline and ellipsoidal (spherical or nearly so in *P. sphaerospora* and *P. subplumbeata* in our area). Even in moribund thecia, any ascospores still present remain hyaline. The episporous is relatively thick, resembling those of a *Pertusaria* but presumably uninucleate in a few species. In a very few species it is thin, showing as a single boundary line under $440\times$ magnification. The size is very uniform for a given species except in those species where 3-4 ascospores abort in part of the asci. In these, the dimensions are correspondingly larger since about the same volume of protoplasm is used in forming the surviving ascospores. In *Everniopsis*, the outer boundary of the protoplast in contact with the episporous is rough, as one sees in the *Pannariaceae*.

Spermogonia. The spermogonia are rather uniform in our area, immersed in the thallus (semimmerged in *Everniopsis*) oblate spheroidal, rarely spherical, the upper portion of the wall about the ostiole dark brown to black, hence usually appearing as black dots on the upper surface of the marginal lobes, very rarely in the center of the thallus or in the apothecial margin or exciple. In four African species they are confined to bullate or subcerebriform prominences resembling the pseudostromata of *Pertusaria*, similar to those species segregated as *Aspidelia* Stirton, based on *A. Beckettii* Stirton from New Zealand, which I know only from the literature. No attempt has been made to section the spermogonia of each species studied, although their structure has been recorded when I have happened to section them. The spermatophores are septate, the spermatia straight, lateral at the septa of the spermatophores.

Chemical reactions. The chemical reactions of the medulla have been recorded for each species, using solutions of NaOH and NaOCl (K and C in the text, respectively), also these reagents in combination (KC in the text). Care should be taken to apply the reagent to the whole thickness of the medulla, as in a few species, the medulla shows only a narrow zone of color under the algal layer, while

a related species shows the color throughout the thickness of the medulla. The upper cortex of many species turns yellow with K, and in some of them the dye diffuses and may stain an adjacent exposed portion of the medulla, giving an erroneous appearance of a medullar reaction with K. Apparently some of Nylander's reports of medullar reactions are due to this error.

While I have never depended solely on chemical reactions of the medulla in defining species, I have found such reactions useful with fragmentary or sterile specimens and have often recorded reactions in my key to species, as characters easily observed. Usually a thallus growing in bright sunlight gives a more prompt and definite reaction than one of the same species in dense shade. In a few cases, I have referred specimens to a species when the morphological characters agree with those of the original description, although the chemical reactions observed do not agree. In all such cases, I have mentioned such discrepancies in a note following the formal description.

PARMELIACEAE

Thallus foliose, appressed to erect and subfruticose, dorsiventral, usually corticate on both surfaces, ecorticate below in *Anzia*; algae *Trebouxia*; underside nude or covered with rhizinae which rarely anastomose to form a hypothallus in *Pannoparmelia* and *Anzia*. Apothecia circular, sessile to stipitate; amphithecium well developed; paraphyses simple or dichotomous above the asci, usually conglutinate in the thecial gel; asci normally 8-spored, sometimes less by abortion and 16-32-spored in *Anzia* and *Candelaria*; ascospores hyaline, unicellular, ellipsoid to almost spherical (septate in *Megalopsora* and *Physcidia*). Spermatogonia with septate spermatophores, simple in *Parmeliopsis* and *Anzia*.

KEY TO GENERA OF PARMELIACEAE IN AFRICA SOUTH OF 15° N.

1. Thallus attached to the substrate by secretion of adhesive gel from the lower cortex; without rhizinae; lobes narrow, often subterete, appressed to suberect; medulla loosely woven, sometimes hollow in the center.....HYPOGYMNIA 2
 1. Thallus attached to substrate by rhizinae.....2
 1. Thallus attachment to substrate unknown, probably a rooting base or gomphus, lobes suberect, recumbent or pendent; not rigid; rhizinae absent or non-functional; cilia when present long, slender.....3
 1. Thallus attached by a central or eccentric gomphus, resembling the Umbilicariaceae in habit; thallus very rigid; coarse short cilia and non-functional rhizinae may be present.....OMPHALODIUM
 2. Lower cortex pseudoparenchymatous from either longitudinal or fastigiate hyphae.....PARMELIA
 2. Lower cortex of conglutinate longitudinal hyphae, not pseudoparenchymatous.....PSEUDEVERNIA
 3. Medulla of longitudinal hyphae not conglutinate; cilia or non-functional rhizinae often present.....PSEUDEVERNIA
 3. Medulla of conglutinate longitudinal hyphae; cilia and rhizinae absent; a single species in our area.....EVERNIOPSIS
- Thallus olive buff above, isabella color below, subnitid, lobes flat, dichotomous, 2-3 mm. wide below, 1 mm. above, 10 cm. long, probably pendent; apothecia 2 mm. in diameter; ascospores $16 \times 10 \mu$, exospore internally rough as in the Pannariaceae.....*E. pseudoreticulata* (Duvign.) Dodge

HYPOGYMNIA

HYPOGYMNIA Nyl., Lich. Env. Paris 39. 1896.

Parmelia subg. *Hypogymnia* Nyl., Flora 64:537. 1881.

Type: *Parmelia physodes* (L.) Ach.

Thallus small, polyphyllous, lobes narrow, more or less linear, convex, lobes or ultimate lobules often nearly terete, inflated, sometimes hollow in the center, frequently with irregular blackened areas above, appressed to the substrate or attached only in the central portions by the secretion of an adhesive substance from the lower cortex, without rhizinae, the outer portions of the lobes often free ascending to erect to recumbent; morphologic upper cortex of conglutinate fastigate hyphae or of fastigate pseudoparenchyma; algal layer under the morphologic upper cortex only, not in a radiate structure of a *Dactylina* and the terete, inflated species of *Ramalina*; medulla K-, C-, KC-, arachnoid or of loosely woven longitudinal hyphae with large air spaces, sometimes hollow in the center, sometimes the hyphae next the morphologic lower cortex larger with brownish thicker walls. Reproduction more often by fragmentation, isidia or soredia; apothecia relatively rare, asci thinwalled at maturity, only the tips thickened when young; ascospores ellipsoidal, small, under $10\ \mu$ long; spermatogonia not seen in our African material.

The genus is characteristic of alpine and subalpine areas, at very high elevations in the tropics; saxicolous, terricolous or on twigs and small branches rather than on trunks and larger branches in deep shade. The genus is found at low elevations in the Subarctic and in the Subantarctic islands.

KEY TO HYPOGYMNIA

1. Lobes suberect, 1.5 mm. wide.....2
1. Lobes appressed to the substrate.....3
 2. Lobes densely isidiose, light buff, underside black, ultimate lobules terete, 0.3–0.4 mm. in diameter; corticole; Uganda.....*H. cornuta* Dodge
 2. Lobes not isidiose, smooth, pale yellow, underside black; saxicole; South West Africa.....*H. deserti* (Hue) Dodge
3. Underside chamois in center, black in the outer 2 cm., upper surface cracked into polygonal areoles 1–2 mm. in diameter, irregularly dichotomous, lobes narrowly black margined; apothecia up to 6 mm. in diameter; ascospores $8-9 \times 3-4\ \mu$; Southern Rhodesia.....*H. rhodesiana* Dodge
3. Underside black, rugose, upper surface between citrine drab and buffy brown, lobes 1–2 mm. wide, dichotomous; apothecia up to 7 mm. in diameter, exciple rugose sulcate, subscrobiculate; ascospores $6 \times 4\ \mu$ (immature?); Mauritius.....*H. inflata* Dodge
3. Underside, black, rugose; sterile.....4
 4. Medulla hollow in center, upper layer of longitudinal hyphae, lower arachnoid; lobes irregularly dichotomous, tips digitate; central lobules capitate soraliate; Uganda.....*H. elgonensis* Dodge
 4. Medulla not hollow, tips of lobes not capitate soraliate.....5
5. Lobes dichotomous to subpinnate with digitate tips; medulla of longitudinal, nubilated hyphae in the upper fourth, the rest arachnoid; Tanganyika.....*H. kiboensis* Dodge
5. Lobes palmately branched; medulla arachnoid, with thickwalled, brown hyphae in the lower half.....*H. sp.*

HYPOGYMNIA *cornuta* Dodge, sp. nov.

Type: Uganda, Mt. Elgon, 3550 m., on twigs of heath trees in alpine meadow, A. S. Thomas 607 p. p. min. ex herb. Dept. Agr. Uganda at Kew.

Thallus erectus (aut pendens), 3 cm. altitudine, inferne ca. 1 mm. altitudine, usque ad 2 mm. ad primam dichotomiam, repetite dichotome ramosus, internodis inferis brevibus, superis ad 6 mm. longitudine, lobulis ultimis teretibus, ca. 1 mm. longitudine, 0.3–0.4 mm. diametro, apicibus nigris; superficies superior pallide

alutacea, lobis aliis dense isidiosis, isidiis simplicibus, aliis laevibus aut longitudinaliter rugosis et subscrobiculatis; superficies inferior nigra, opaca, rugosa aut subscrobiculata, sine rhizinis; cortex superior $15\ \mu$ crassitudine, hyphis fastigiatis, conglutinatis, cellulis terminalibus clavatis aut subsphaericis; stratum algarum usque ad $30\ \mu$ crassitudine, coloniis discretis et cellulis singulis *Trebouxiae*, $7-9\ \mu$ diametro; medulla K-, C-, KC-, $130\ \mu$ crassitudine, arachnoidea, hyphis pachydermeis, $3\ \mu$ diametro, non nubilatis; cortex inferior superiori similis. Apothecia spermogoniaeque non visa.

Thallus erect or pendent, 3 cm. tall, about 1 mm. wide below expanding to 2 mm. at the first dichotomy, repeatedly dichotomous, lower internodes short, upper about 6 mm. long, ultimate lobules 1 mm. long, 0.3-0.4 mm. in diameter, black tipped; upper surface light buff, some lobes densely isidiose, isidia simple, other lobes smooth, longitudinally rugose and subscrobiculate; underside black, except on outer lobes, surface dull, rugose to subscrobiculate, without rhizinae; upper cortex $15\ \mu$ thick, of fastigiate, conglutinate hyphae, outermost cells clavate to subspheric; algal layer up to $30\ \mu$ thick, of discrete colonies and single cells of *Trebouxia*, cells $7-9\ \mu$ in diameter; medulla K-, C-, KC-, $130\ \mu$ thick, very arachnoid, hyphae thickwalled, $3\ \mu$ in diameter, not nubilated; lower cortex similar to the upper cortex. Apothecia and spermogonia not seen.

While the habit resembles *Pseudevernia*, the structure is clearly that of *Hypogymnia*.

UGANDA: Mt. Elgon, 3550 m., on twigs of heath trees in alpine meadow, A. S. Thomas 607 p. p. min. ex herb. Dept. Agr. Uganda at Kew.

HYPOGYMNIA rhodesiana Dodge, sp. nov.

Type: Southern Rhodesia, Makoni, Forest Hill Kop, 1610 m., on sloping rock faces; curled up or flat, grey above, brown below; *Frederick Eyles* 825 at Kew.

Thallus foliosus, 8 cm. diametro, pallide olivaceo-alutaceus; lobis inferne 5 mm. latitudine, irregulariter dichotomis, lobulis ultimis ca. 1 mm. latitudine, apicibus truncatis aut subretusis, anguste nigromarginatis; superficies superior laevis, subnitida, rimoso-areolata, areolis polygonis, 1-2 mm. diametro, inferior irregulariter rugosa, centro alutacea, marginibus nigris, opaca; cortex superior $40\ \mu$ crassitudine, dimidia parte externa hyphis septatis longitudinalibus, $4\ \mu$ diametro, granulis brunneo-viridibus nubilatis, parte interiori fastigiata, pseudoparenchymatica, hyalina; stratum algarum ca. $30\ \mu$ crassitudine, continuum, cellulis $5-6\ \mu$ diametro; medulla K-, C-, KC-, $200\ \mu$ crassitudine, dimidia parte superiori arachnoidea, hyphis verticalibus $5-6\ \mu$ diametro, parte inferiori densa, hyphis longitudinalibus; cortex inferior $10\ \mu$ crassitudine, nigro-brunneus, hyphis longitudinalibus, cellulis rotundatis.

Apothecia ad 6 mm. diametro, sessilia, superficialia aut submarginalia, margine integro inflexo; excipulo laevi aut subruguloso, disco castaneo; cortex amphithecialis $30-35\ \mu$ crassitudine, superne cum stratis uno vel duobus hyphis periclinalibus, aliter fastigiatis, hyphis pachydermeis; stratum algarum ca. $20\ \mu$ crassitudine, cellulis sparsis, sub parathecio melius evolutum; medulla arachnoidea; parathecium $30\ \mu$ crassitudine, fastigiatum, hyphis conglutinatis; hypothecium

15 μ crassitudine, hyphis tenuibus, septatis, periclinalibus; thecium 35 μ altitudine; paraphyses tenues, apicibus clavatis, brunneo-viridibus; asci cylindrico-clavati, 22–25 \times 7–8 μ , apicibus incrassatis; ascosporae octonae, distichae, ellipsoideae, 8–9 \times 3–4 μ .

Thallus foliose, 8 cm. in diameter, pale olive buff, lobes 5 mm. wide below, irregularly dichotomous, narrower at each dichotomy, ultimate lobules about 1 mm. wide, tips truncate to slightly retuse, narrowly black margined, surface smooth, subnitid, cracked into the medulla, forming polygonal areas 1–2 mm. in diameter, edges blackened in the older portions of the thallus; another much younger thallus 4 cm. in diameter is similar but smaller in all dimensions with lobes tending to become pinnate, ultimate lobules only 0.8 mm. wide and relatively longer; underside irregularly short rugose, chamois near the center shading to black in the outer 2 cm., surface opaque; upper cortex 40 μ thick, the outer half of septate longitudinal hyphae 4 μ in diameter nubilated with minute greenish brown granules, the lower half fastigiate, hyaline with nearly isodiametric cells; algal layer about 30 μ thick, continuous, of scattered single cells 5–6 μ in diameter and small colonies of *Trebouxia*; medulla K–, C–, KC–, 200 μ thick, the upper half very arachnoid of predominantly vertical hyphae 5–6 μ in diameter, the lower half of longitudinal hyphae increasingly densely interwoven toward the lower cortex; lower cortex 10 μ thick, very dark brown, of longitudinal hyphae, the outermost rather closely septate, the outer cell walls rounded giving the opaque appearance of the surface.

Apothecia up to 6 mm. in diameter, sessile, superficial to submarginal, margin entire, inrolled, exciple smooth to slightly rugose, disc chestnut; amphithecial cortex 30–35 μ thick with 1–2 layers of periclinal hyphae, the rest fastigiate, of very thickwalled hyphae with narrow lumina; algal layer about 20 μ thick, of very scattered algal cells, apparently moribund; medulla arachnoid throughout; algal layer under the parathecium better developed, about 20 μ thick, forming a continuous layer but cells not closely packed; parathecium 30 μ thick, fastigiate, hyphae conglutinate, slenderer with relatively larger lumina than in the cortex; hypothecium 15 μ thick, of slender septate hyphae; thecium 35 μ tall; paraphyses slender, tips clavate, thickwalled, greenish brown, 3-celled; asci cylindric-clavate, 8-spored, 22–25 \times 7–8 μ , tips thickened; ascospores distichous, ellipsoid, 8–9 \times 3–4 μ with a moderately thick epispore.

SOUTHERN RHODESIA: Makoni, Forest Hill Kop, 1610 m., on sloping rock faces, Frederick Eyles 825 at Kew.

HYPOGYMNIA inflata Dodge, sp. nov.

Type: Mauritius, without locality or collector, herb. Hookerianum at Kew, growing with hepatics, substrate unknown.

Thallus suberectus aut decumbens, lobis ca. 20 mm. altitudine, multoties dichotomis, ad internodos ca. 1 mm. latitudine, 1.5–2 mm. infra nodos, basi emoriens, apicibus hemisphaericis, subteretibus, superne siccitate subconvexis, inferne rugosis, rugis anastomosantibus, longitudinalibus, cavis, superne superficie inter citrinorava et alucaceo-brunnea, inferne nigra nitenti, longis cum prominentibus paucis aut papillis inter hepaticis substrato tegens; cortex superior 15 μ crassi-

tudine, pseudoparenchymatice fastigiatus, cellulis $3\ \mu$ diametro, luminibus $2\ \mu$ diametro, granulis minutis brunneis nubilatus; stratum algarum $35\ \mu$ crassitudine, continuum, cellulis $5-6\ \mu$ diametro; medulla K-, C-, KC-, superne $40\ \mu$ crassitudine, hyphis pachydermeis, ramosis, laxe contextis, $3\ \mu$ diametro, granulis hyalinis nubilatis, inferne $35\ \mu$ crassitudine, hyphis pachydermeis brunneis longitudinalibus, $3\ \mu$ diametro, laxissime contextis, non nubilatis; cortex inferior stratum hypharum $8\ \mu$ diametro, septatarum, cellulis isodiametricis.

Apothecia superficialia, ad nodos superiores, margine integro, excipulo longitudinaliter rugoso dein subscrobiculato, disco castaneo; cortex amphithecialis $55\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, cellulis $8-9\ \mu$ diametro, protoplastis $2.5-3\ \mu$, irregulariter strato amorpho $10-12\ \mu$ crassitudine obtectus; stratum algarum coloniis discretis sparsis $15\ \mu$ diametro; medulla laxa contexta aut arachnoidea; stratum algarum sub parathecio $30\ \mu$ crassitudine, continuum; parathecium ca. $15\ \mu$ crassitudine pseudoparenchymatice fastigiatus; hypothecium ca. $15\ \mu$ crassitudine, hyphis tenuibus periclinalibus; thecium $40\ \mu$ altitudine; paraphyses tenues septatae, semel bisve dichotome super ascos ramosis, ramis moniliformibus, apicibus clavatis; asci clavati, ca. $30 \times 10\ \mu$, apicibus juventute incrassatis; ascosporae octonae, ellipsoideae, $6 \times 4\ \mu$ (immaturae?).

Thallus probably suberect or decumbent, lobes about 20 mm. tall, several times dichotomous, about 1 mm. wide at the internodes, expanding to 1.5-2 mm. just below the next internode, tips hemispheric, dying at the base, probably nearly terete when growing, drying subconvex above, very deeply rugose below, wrinkles anastomosing but predominantly longitudinal, hollow; morphologic upper surface drying between citrine drab and buffy brown, shining, underside black and shining with occasional relatively large and long papilliform prominences, penetrating between the hepatics to make contact with the substrate, on the lower portions of the lobes; morphologic upper cortex $15\ \mu$ thick, of fastigate pseudoparenchyma, cells about $3\ \mu$ in diameter, lumina $2\ \mu$, in a gel nubilated with minute brownish granules; algal layer $30\ \mu$ thick, continuous, cells closely packed, $5-6\ \mu$ in diameter; medulla K-, C-, KC-, the layer next the algal layer about $40\ \mu$ thick, of very loosely woven thickwalled branched hyphae $3\ \mu$ in diameter, nubilated with hyaline granules; the layer next the lower cortex $35\ \mu$ thick, very arachnoid, hyphae thickwalled, brownish, $3\ \mu$ in diameter, not nubilated, predominantly longitudinal; lower cortex a layer of longitudinal hyphae $8\ \mu$ in diameter, deep brown, septate into isodiametric cells.

Apothecia superficial at an upper node (or perhaps a modified lobule); margin entire, exciple longitudinally rugose becoming subscrobiculate, disc chestnut; amphithecial cortex $55\ \mu$ thick, of gelified fastigate pseudoparenchyma, cells $8-9\ \mu$ in diameter, protoplasts $2.5-3\ \mu$, irregularly overlaid with an amorphous layer $10-12\ \mu$ thick; algal layer of very scattered, discrete colonies of *Trebouxia* about $15\ \mu$ in diameter; medulla loosely woven to arachnoid; algal layer under the parathecium $30\ \mu$ thick, with an occasional cell deeper in the medulla, continuous; parathecium about $15\ \mu$ thick but almost disappearing in places, of fastigate thickwalled pseudoparenchyma; hypothecium about $15\ \mu$ thick, of slender, deeply

staining periclinal hyphae; thecium $40\ \mu$ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches moniliform, tips clavate, reaching the surface of the brownish epithelial gel; asci clavate, about $30 \times 10\ \mu$, tips thickened when young, protoplast long mammillate; ascospores ellipsoidal, $6 \times 4\ \mu$, probably immature.

There are a few pores at the tips of the lobes, but I have been unable to decide if they are normal or teratologic, probably the latter, as one appears as if the tip had been eaten by an insect and the cortex regenerated. Only more and better collections can decide the matter.

MAURITIUS: without locality or collector, growing with hepatics, substrate unknown, herb. Hookerianum at Kew.

HYPOGYMNIA elgonensis Dodge, sp. nov.

Type: Uganda, Mt. Elgon, Masaba, 4400 m., on ground with moribund *Cladonia* in alpine meadow, A. S. Thomas 621 at Kew.

Thallus foliosus, inter alutaceus et olivaceo-alutaceus, lobis ad 20 mm. longitudine, ad basin 3 mm. latitudine, irregulariter dichotomis, apicibus rotundatis, digitatis, lobulis ultimis $1 \times 1\ \text{mm.}$, inflatis, excavatis, capitate sorediatis, sorediis granulosis; superficies inferior nigra, rugosa, nitida; cortex superior $20\text{--}25\ \mu$ crassitudine, gelifactus, pseudoparenchymatice fastigiatus, cellulis $3\ \mu$ diametro, luminibus $1\ \mu$, strato amorpho $3\ \mu$ crassitudine tectus; stratum algarum $25\text{--}30\ \mu$ crassitudine, cellulis singulis $7\text{--}10\ \mu$ diametro et coloniis parvis subdiscretis *Trebouxiae*; medulla K-, C-, KC-, $75\text{--}80\ \mu$ crassitudine, superne et inferne hyphis longitudinalibus laxo contextis, ad centrum arachnoideis aut nullis; cortex inferior $15\ \mu$ crassitudine, niger, pseudoparenchymatice fastigiatus, gelifactus. Apothecia spermogoniae non visa.

Thallus forming patches 9 cm. in diameter, between buff and olive buff, darkening to bister, pale gray where moribund, peripheral lobes up to 20 mm. long, 3 mm. wide at the base, irregularly dichotomous and subdichotomous, tips rounded, digitate, lobules about 1 mm. long and wide, somewhat inflated, hollow in the center; central lobules becoming capitate sorediate, soredia coarse, granular; underside black shading to Brussels brown on the ultimate lobules, rugose, shining, without rhizinae; upper cortex $20\text{--}25\ \mu$ thick, of gelified, fastigate pseudoparenchyma, cells about $3\ \mu$ in diameter, lumina $1\ \mu$, heavily nubilated without, less so within, covered by an amorphous layer $3\ \mu$ thick; algal layer $25\text{--}30\ \mu$ thick, of solitary cells and small discrete colonies in a nearly continuous layer, cells $7\text{--}10\ \mu$ in diameter; medulla K-, C-, KC-, $75\text{--}80\ \mu$ thick, of loosely woven longitudinal hyphae $3\ \mu$ in diameter next the algal layer, very arachnoid toward the hollow center, $30\ \mu$ thick next the lower cortex; lower cortex $15\ \mu$ thick, of gelified fastigiate pseudoparenchyma. Apothecia and spermogonia not seen.

KENYA: west slope of Mt. Kenya, on trail from West Kenya Forest Station to summit, 3630 m., muscicole, Edgar A. Mearns 1612 p. p., T. Roosevelt Exp.

UGANDA: Mt. Elgon, Masaba, 4400 m., on ground with moribund *Cladonia* in alpine meadow. A. S. Thomas 621 at Kew, type.

HYPOGYMNIA kiboensis Dodge, sp. nov.

Type: Tanganyika, Mt. Kilimanjaro, between saddle and Kibo, 4830–5475 m., on volcanic rock, *B. Verdcourt* & *M. Wilkinson 1228* in E. African Herb.

Thallus foliosus, 3.5 cm. diametro, lobis marginalibus olivaceo-alutaceis, anguste nigromarginatis, laevibus, opacis, inferne nigris, rugosis aut minute scrobiculatis, subimbricatis, centro dichotomis, dein pinnatis lobulis ultimis digitatis, subteretibus, ca. 1×0.2 mm.; cortex superior 20μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6μ diametro, dimidia parte externa brunnea; stratum algarum coloniis discretis *Trebouxiae*, 15μ diametro, cellulis $6-7 \mu$; medulla K-, C-, KC-, 200μ crassitudine supra hyphis longitudinalibus nubilatis, infra arachnoidea; cortex inferior $15-20 \mu$ crassitudine, niger, fastigiatus, cellulis $15 \times 10 \mu$.

Thallus foliose, 3.5 cm. in diameter, K-, marginal lobes olive buff shading to citrine drab at the center, narrowly black-margined, smooth, opaque; underside black, rugose to minutely scrobiculate, bleached by C, without rhizinae or cilia; lobes subimbricate, dichotomous near the center then pinnately branched, ultimate lobules digitate and subterete, about 1×0.2 mm.; upper cortex 20μ thick, of fastigate pseudoparenchyma, cells about 6μ in diameter, outer half brownish; algal layer of discrete colonies 15μ in diameter and single cells of *Trebouxia*, $6-7 \mu$ in diameter; medulla K-, C-, KC-, 200μ or more thick, the upper 50μ of moderately interwoven longitudinal hyphae, nubilated with minute hyaline granules, the rest arachnoid or very loosely interwoven with large air spaces; lower cortex $15-20 \mu$ thick, black, fastigate, cells $15 \times 10 \mu$ cutting off thickwalled spherical cells about 4μ in diameter, accounting for the opaque underside.

The systematic position of this species is not clear. The anatomy of the thallus is somewhat suggestive of *Umbilicaria Haumaniana* Frey, but when the thallus was carefully dissected from the underlying rock, there was no sign of a central holdfast. The color of the upper surface is much lighter than any species of the Umbilicariaceae known to me, being somewhat intermediate between *Hypogymnia* and section *Xanthoparmelia* of *Parmelia*, both of which have a subnitid lower cortex while our species is very dull. Unfortunately our species lacks both apothecia and spermatogonia. In thalline anatomy our species is much closer to *Hypogymnia* than to section *Xanthoparmelia*. *Hypogymnia* is also more characteristic of very high elevations than is *Xanthoparmelia*.

TANGANYIKA: Mt. Kilimanjaro, between saddle and Kibo, 4830–5475 m., on volcanic rock, *B. Verdcourt* & *M. Wilkinson 1228*, in E. Africa Herb.

HYPOGYMNIA SP.

Type: Kenya, Mt. Elgon, Masaba, 4386 m., on rocks in alpine meadow, *A. S. Thomas 619* p. p. min. ex hb. Botanist, Dept. Agr. Uganda at Kew.

Thallus up to 10 mm. in diameter, branching more or less palmate, ultimate lobes up to 1.5 mm. long, 0.5 mm. broad, somewhat inflated, olive buff above, black-margined, underside black rugose; upper cortex $15-20 \mu$ thick, of fastigate

pseudoparenchyma, nearly hyaline; algal cells moribund, not clearly seen; medulla about 100 μ thick, the upper half of hyaline, slender, loosely woven hyphae, the lower half of loosely woven, branched, brown hyphae of greater diameter and thicker walls than those of the upper half; lower cortex 22–25 μ thick, very black, structure not clearly seen.

The Uganda fragments have more closely woven medullary hyphae and the brownish hyphae of the lower half of the medulla are heavily nubilated with minute granules. I have hesitated to give a name to this species as the specimens are moribund and very fragmentary.

KENYA: Mt. Elgon, Masaba, 4386 m., on rocks in alpine meadow, A. S. Thomas 619 p. p. min. ex herb. Botanist, Dept. Agr. Uganda at Kew.

UGANDA: Imatory Mts., Ibahin, 1620 m. to Itibol 2060 m., on rocks, A. S. Thomas 107 p. p. min. at Kew.

HYPOGYMNIA deserti (Hue) Dodge, comb. cov.

Parmelia physodes f. *deserti* Hue, Nouv. Arch. Mus. [Paris] IV. 1:124. 1899.

Type: South West Africa, Walvis Bay, near seashore on stones in desert, Duparquet.

PARMELIA

PARMELIA Ach., Meth. Lich. 153. 1803.

Imbricaria Ach., K. Vetensk. Akad. Nya. Handl. 15:250. 1794; Michaux, Fl. Bor.-Amer. 2:322. 1803.

Physcia S. F. Gray, Nat. Arr. Brit. Pl. 1:455. 1821, non Schreber, 1791, nor later authors.

Type: *Parmelia saxatilis* (L.) Ach.

Thallus monophyllous, appressed or margins ascending, lobes linear deeply divided almost to the center and appearing polyphyllous, often imbricate; upper surface smooth, rugose or sometimes scrobiculate, isidiose, or rarely sorediose, margins sometimes ciliate, isidiose, lobulate or sorediose; underside usually black, opaque in the center, often lighter at the margins of the lobes; rhizinae usually black, dense or sparse, covering the whole underside or confined to the central portion of the thallus; upper cortex fastigate or of fastigate pseudoparenchyma, usually thickwalled, more or less gelified; algae *Trebouxia*; medulla usually of longitudinal, relatively thickwalled hyphae, rarely arachnoid; lower cortex usually more or less pseudoparenchymatous, sometimes from fastigate hyphae, sometimes from longitudinal hyphae, or of slender thinwalled brownish hyphae, little differentiated from those of the lower medulla in subg. Physcioidae on the Antarctic continent.

Apothecia superficial, sessile to short stipitate, disc concave at first, often becoming nearly plane, brownish, sometimes perforate; amphithecium well developed outside the hyaline parathecium which is usually of fastigate thickwalled pseudoparenchyma, very rarely of thickwalled periclinal hyphae as in *Everniopsis*; paraphyses slender, septate, usually dichotomous above the asci; asci usually thinwalled with only the tip thickened when young, sometimes thickwalled, reminiscent of the

Pertusariaceae; ascospores hyaline, unicellular, ellipsoidal, very rarely spherical, usually with a thick epispore.

Spermogonia mostly oblate spheroidal, immersed in the thallus, rarely in bullate prominences resembling the pseudostromata of Pertusariaceae, or in the young amphithecium; wall thin, blackened about the ostiole, usually pale brown or hyaline below, of periclinal pseudoparenchyma; spermatophores septate; spermatia lateral at the septa of the spermatophores, straight, bacilliform to sub-bifusiform, rather short.

The genus is divided into three subgenera: *Amphigymnia*, lobes broad, rounded, margins with a broad (more than 3 mm. wide) nude zone, rhizinae usually sparse, stout; *Euparmelia*, lobes usually long and slender, rarely somewhat broader and rounded, with the underside covered by rhizinae to the margin or the outer rhizinae reduced to small dark papillae, usually slender, dense, often branched near the tips, sparse but short and slender in a few species of sect. *Xanthoparmelia*; and *Physcioideae*, lower cortex of slender longitudinal hyphae scarcely differentiated from the lower medulla except brownish and usually more closely woven, thus resembling the lower cortex of *Physcia*.

SUBGENUS EUPARMELIA

Parmelia subg. *Euparmelia* Nyl. in Hue, Revue de Bot. 4:375. 1885-6.

Type: *P. saxicola* (L.) Ach.

The subgenus is divided into three sections: *Melaenoparmelia*, thallus dark olivaceous brown to black; *Xanthoparmelia*, thallus yellowish green; and *Hypotrachyna*, thallus glaucous when fresh, drying grayish.

While in general the division of the subgenus *Euparmelia* into sections on the basis of color of the upper surface of the thallus is satisfactory, occasionally there is doubt. Sect. *Melaenoparmelia* seldom gives trouble, although rarely a moribund thallus of a species of the other sections may be blackened, but one can usually find a lobe or lobule which still retains its characteristic color. Sect. *Xanthoparmelia* is often more troublesome when working with old material. Characteristically the fresh moist thallus is "consersa" green, deep lichen green of Ridgway, drying deep olive buff. Unfortunately many species of the glaucous to gray sect. *Hypotrachyna* become shades of olive buff in old specimens. Where I have been at all in doubt, I have included them in the key under each group. If dubious material is not identified in the key to one section, it should be looked for in the other.

SECT. MELAENOPARMELIA

Parmelia sect. *Melaenoparmelia* Hue, Nouv. Arch. Mus. [Paris] IV. 1:138. 1899; *Parmelia* subg. *Euparmelia* sect. *Melaenoparmelia* Zahlbr., in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *P. stygia* (L.) Ach.

Thallus deep olive, chestnut to black; underside covered with rhizinae; apothecia sessile.

1. Medulla orange to reddish, lobes convex, fuscous or darker, fertile; North Congo.....*P. erythrocardia* (Müll. Arg.) Vainio.....2
1. Medulla white (or slightly yellowish in *P. Dregeana*).....2
2. Thallus subcrustose, center areolate with radial peripheral lobes (resembling *Lecanora* subg. *Squamaria*); South Africa.....3
2. Thallus clearly foliose.....6
3. Ascospores about thrice as long as broad; medulla K yellow then red.....4
3. Ascospores about twice as long as broad.....5
4. Ascospores $8-11 \times 3.5-4 \mu$; apothecia small.....*P. squamariata* Nyl.
4. Ascospores $9-10 \times 3 \mu$; apothecia 2-4 mm. in diameter, margin entire, inflexed; medulla C yellow, KC red; saxicole.....*P. fissurina* Zahlbr.
5. Ascospores $7-8 \times 3-6 \mu$; apothecia 5-7 mm. in diameter, margin subentire, subflexuous; medulla K yellow, C-, KC-.....*P. squamans* Stzbgr.
5. Ascospores $7-9 \times 5-5.5 \mu$; apothecia up to 2.5 mm. in diameter, margin crenulate; medulla K yellow ferruginous, C yellow orange; saxicole.....*P. melancholica* Steiner & Zahlbr.
5. Ascospores $7-10 \times 4-6 \mu$*P. proluxa* v. *applicata* Stzbgr.
5. Ascospores $10-14 \times 5-7 \mu$; apothecia 0.5-2 mm. in diameter, margin crenulate, flexuous; medulla K yellow then red; lobes narrow, convex; underside stramineous or ochroleucous.....*P. perplexa* Stzbgr.
6. Ascospores $9-15 \times 3.5-4.5 \mu$; apothecia up to 1 mm. in diameter, margin subentire; medulla K yellow then red; lobes 0.5 mm. wide.....*P. proluxa* Nyl.
6. Ascospores $6-9 \mu$ long, ellipsoid.....7
6. Ascospores under 6μ in diameter, subspherical.....8
7. Thallus pale beneath, lobes short, turgid; apothecia 1.5-2.5 mm. in diameter, margin thin, entire; ascospores $6-9 \times 4.5-6 \mu$; South West Africa.....*P. conturbata* Müll. Arg. With subserotiose white points or lines above.....v. *exornata* Zahlbr.
7. Thallus ochro-fuscous beneath, lobes convex, dichotomous, lobules subcrenate; apothecial margin entire; ascospores $7-9 \times 4-6 \mu$; medulla KC red; Transvaal.....*P. oleagina* Stzbgr.
7. Thallus fuscous beneath with black margins, lobes 3 mm. long; apothecia up to 2 mm. in diameter, margin entire; ascospores $8.5-9 \times 6-7 \mu$; medulla K yellow, later red, C-, KC- or finally slightly red under the algal layer; saxicole; Cape of Good Hope.....*P. van-der-Bijlii* Zahlbr.
8. Lobes 1 mm. wide, linear, dichotomous, subconvex; apothecia 1.5 (-2) mm. in diameter, margin subcrenulate; ascospores $5-6 \times 5 \mu$; medulla white or slightly yellowish, K-, C and KC rose-purple; saxicole; Cape of Good Hope.....*P. Dregeana* Hampe
8. Lobes 0.4-0.7 mm. wide, 3-5 mm. long, convex, pale below; apothecia 1-1.4 mm. in diameter, margin very thin, entire, exciple pale; ascospores $3.5-4 \mu$ in diameter; medulla K yellow orange, C-, KC- or slowly yellowing; South West Africa.....*P. namaensis* Steiner & Zahlbr.

PARMELIA (MELAENOPARMELIA) DREGEANA Hampe in Nyl., Syn. Meth. Lich. 1:398. 1860.

Type: Cape of Good Hope, on quartzose rock, *Drège*.

Thallus about 3 cm. in diameter, slate gray, tips of lobes grayish olive, lobes radiating, not imbricate, dichotomous, 0.5-1 mm. wide, tips truncate to retuse, flat to slightly convex, surface smooth, underside honey yellow with scattered tufts of slender, dark rhizinae, densely branched at the tips; upper cortex 15 μ thick, outermost cells $5 \times 3 \mu$ with thick greenish black walls, the rest hyaline, of thinwalled, dichotomous vertical hyphae about 3 μ in diameter; algal layer 30 μ thick of single colonies up to 4 cells, widely scattered between the subvertical medullary hyphae, cells 11-12 μ in diameter; medulla K-, C rose-purple, KC rose purple, 100-115 μ thick, of very loosely woven hyphae with large air spaces especially in the middle, more longitudinal and closely woven under the algal layer and next the lower cortex; lower cortex pale brownish to hyaline, gelified, 7-10 μ thick, of pseudoparenchyma from longitudinal hyphae, 3.5-5 μ in diameter.

Apothecia sessile, up to 2 mm. in diameter, margin minutely crenulate, somewhat incurved, exciple nearly chamois, smooth; disc shining, auburn or darker; amphithecial cortex 55(-60) μ thick, gelified, outer half fastigiate, lumina about

1 μ in diameter, inner half nearly periclinal; algal layer of a few scattered cells about 30–50 μ inside the medulla, apparently dying out below; medulla very loosely woven, almost arachnoid, tearing badly in sectioning; parathecium 15 μ thick, gelified, of fastigate pseudoparenchyma, protoplasts spherical, about 1 μ in diameter; hypothecium about 15 μ thick, of slender, thickwalled periclinal hyphae, conglutinate; thecium 65 μ tall; paraphyses slender, closely septate, branching above the asci, the ends of the branches moniliform in the brownish epithelial gel; asci clavate, 45 \times 10 μ , wall and tip about 3 μ thick; ascospores subspherical, 5–6 \times 5 μ .

At first sight this species looks like a dark gray *Physcia*, but anatomically it is clearly a *Parmelia*.

CAPE OF GOOD HOPE: Simon's Bay, saxicole, Charles Wright, U. S. North Pacific Exploring Exp. sub *P. conspersa* "CaCl roseo-purp." in Tuckerman Herb. at Farlow Herb.

SECT. XANTHOPARMELIA

Parmelia sect. *Xanthoparmelia* Vainio, Etude Lich. Brésil 1:60. 1890.

Parmelia subg. *Euparmelia* sect. *Xanthoparmelia* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *P. conspersa* Ach.

Thallus usually appressed to the substrate, yellowish green; lobes eciliate, underside usually black, but more often pale with pale rhizinae than in sect. *Hypotrachyna*, covered completely with rhizinae, although they are sparse but short and slender or in small discrete groups in some species; medulla usually white, but is pink to cinnabar or pale yellowish to orange in a few species; apothecia superficial, small, sessile constricted at the base, rarely very slightly substipitate, disc imperforate; parathecium of fastigate hyphae or pseudoparenchyma (except in *P. Eylesii*); asci usually thinwalled with tips thickened when young with a few species having walls up to 2 μ thick; ascospores small, under 11 μ long. Spermatogonia of the usual type, but immersed in bullate prominences resembling the pseudostromata of *Pertusaria*, in *Parmelia bipindensis* and *P. concolor*.

1. Medulla red or at least rose maculate.....2
1. Medulla some shade of yellow, at least in upper part.....3
1. Medulla white (or color not given and presumed white).....6
2. Medulla cinnabar red, sometimes only rose or rose maculate, K violascent, C violet, KC evanescent violet; surface smooth; underside pale; apothecia 2 mm. in diameter, margin subcrenate; ascospores 8–10 \times 6 μ ; spermatia 6 \times 0.6–0.7 μ ; saxicole.....*P. endomiltoides* Nyl.
2. Medulla rose, K yellow then red, KC red; lobes with cylindric then flattened microphylline "isidia" 10–15 mm. long.....*P. pseudoconspersa* Gyelnik
3. Thallus isidioides asperate, at least toward the center.....4
3. Thallus sorediose, soralia 2–4 mm. in diameter on central lobes; underside black; lobes 5–10 mm. wide; sterile; Réunion.....*P. albidostrominea* Hue
3. Thallus without isidia or soredia.....5
4. Medulla partly white, partly orange yellow, K yellow, C–, KC red; isidia verrucose, ovoid; lobes appressed, 1–1.5 mm. wide, branched; underside fuscous; North Congo.....*P. endochrysa* (Müll. Arg.) Gyelnik
4. Medulla clay-color maculate, K red, C–, KC red; lobes plane; underside pale; saxicole; Zanzibar.....*P. adplanata* v. *isidiigera* Müll. Arg.
5. Medulla clay-color maculate, K red, C–, KC red; lobes plane; underside pale; saxicole; Zanzibar.....*P. adplanata* Müll. Arg.
5. Medulla pale lemon yellow, K–, C evanescent orange; KC–; underside buffy brown with very pale rhizinae; central lobes bullate with many spermatogonia; marginal lobes pinnate, very revolute; corticole; Cameroons.....*P. bipindensis* Dodge

5. Medulla deep colonial buff, K orange, C orange, KC-; underside brown with dark rhizinae; marginal lobes dichotomous; saxicole; Cape of Good Hope..... *P. Taylori* Dodge
5. Medulla pale citrine, K-, C-, KC orange red; underside black; marginal lobes 4-6 mm., subrotund; apothecial margin thick; ascospores spherical, 8 μ in diameter; Réunion..... *P. sphaerospora* Nyl.
6. Thallus isidiose7
6. Thallus sorediose13
6. Thallus neither isidiose nor sorediose.....15
7. Isidia cylindric to coralloid, lobes usually more than 2 mm. wide.....8
7. Isidia short, almost verrucose, lobes usually 0.5-2 mm. wide.....10
8. Medulla K-, C-9
8. Medulla K-, C rose, KC faint pink; lobes 2-3 (-5) mm. wide; apothecia up to 7 mm. in diameter, exciple isidiose; ascospores 10-13 \times 5-6.5 μ ; corticole; Guinée.....
P. djalensis des Abb.
8. Medulla K yellow, red next the algal layer, C-, KC rose; lobes rounded; exciple isidiose; Réunion..... *P. Gyniki* Dodge
9. Medulla KC reddish violet; isidia coralloid; apothecia 7 mm. in diameter, exciple isidiose; ascospores 10-11 \times 5 μ ; Cape of Good Hope..... *P. persidiosa* Nyl.
9. Medulla KC violet, lobes rounded; sterile; Nyasaland; belongs in subg. *Amphigymnia*.....
P. ecaperata Müll. Arg.
9. Medulla KC wine red; lobes 1.5-2 (-2.5) mm. wide, linear, tips truncate; isidia mostly simple, a few coralloid; apothecia 2 mm. in diameter, exciple smooth or slightly isidiose; sparsely rhizinoe below; ascospores 7-8 \times 4.5-5.5 μ ; corticole; Côte d'Ivoire.....
P. abstrusoides des Abb.
9. Medulla KC-; lobes ciliate, 10-12 mm. wide, terricole; Madagascar..... *P. xanthina* (Müll. Arg.) Vainio
9. Medulla KC-; lobes eciliate, up to 15 mm. long, 3-4 mm. wide; underside Saccardo's umber to clay color; rhizinae in scattered groups; sterile; Mauritius..... *P. subhypoclysta* Dodge
10. Medulla K-11
10. Medulla K pale yellow, C-, KC-; corticole; Mozambique..... *P. mozambica* Vainio
10. Medulla K yellow then red.....12
10. Medulla reaction unknown; thallus 3-5 cm. in diameter, lobes radial, 0.5 mm. wide; rhizinae rare; apothecia less than 1 mm. in diameter; ascospores 7-9 \times 3-4 μ ; on quartz; Congo..... *P. congensis* Stein
11. Medulla C evanescent pink, KC-; thallus membranous; Sierra Leone..... *P. njalonensis* Dodge
11. Medulla C red; thallus fragile, lobes not radiating; isidia often breaking down into soredia; corticole; Cape of Good Hope..... *P. aleuriza* Vainio
12. Medulla KC slightly rose; lobes dichotomous, 1-2 mm. wide; sterile; corticole; Comoro Islands, Kenya and Uganda..... *P. Decaryana* Gynelik
12. Medulla KC fusco-red; lobes short, crenate or sinuate dissected; apothecia 3-7 mm. in diameter, margin thick; ascospores 18-26 \times 11-15 μ ; saxicole; Cape of Good Hope..... *P. xanthotropa* Stirton
13. Medulla K-, C red; corticole; S. Africa.....14
13. Medulla K yellow then red, C-, KC-; lobes very narrow, 10 \times 1 mm.; central lobes much smaller; soralia large, superficial; St. Helena..... *P. Wildeae* Dodge
14. Thallus ashy yellow, black below, isidiose at first, isidia breaking down into minute soredia; fertile..... *P. aleuriza* Vainio
14. Thallus pale glaucous, pale below, soralia superficial, 0.2-0.3 mm. in diameter; fertile..... *P. Bijlii* Vainio
15. Habit of stenophyllous *P. conspersa*, poorly described; Cape of Good Hope.....16
15. Habit of *Lecanora* subg. *Squamaria*, i.e. central portion areolate with marginal lobes.....17
15. Thallus clearly foliose.....20
16. Lobes constricted, pale below..... *P. constrictans* Nyl.
16. Lobes not constricted; black below..... *P. stenophylla* f. *bypomelena* Vainio
17. Medulla K-, C-; apothecia up to 2 mm. in diameter; ascospores 10-13 \times 6-7 μ ; spermatia 5-5.5 \times 0.5-0.7 μ ; marginal lobes 3-7 \times 1-2 mm., 2-3-ctotomous; saxicole; Cape of Good Hope..... *P. Brunnthaleri* Steiner & Zahlbr.
17. Medulla K yellow.....18
17. Medulla K yellow then red, C-, KC red.....19
18. Apothecia 0.3-1.5 mm. in diameter; ascospores 8-10 \times 4-6 μ ; thallus pale sulfur color..... *P. perspersa* Stzbr.
18. Apothecia 0.5-0.7 mm. in diameter; ascospores 9-11 \times 5-7 μ ; saxicole..... *P. adhaerens* Nyl.
18. Apothecia 0.3-1 mm. in diameter; ascospores 14-15 \times 5-6 μ ; lobes on a black hypothallus without rhizinae, probably a true *Lecanora*..... *P. interrupta* Stzbr.
19. Apothecial disc bay; thallus lobes 3-4 \times 2 mm., probably ashy sulfur at first, darkening to steel green or fuscous olive; rhizinoe below..... *P. ebalybeizans* (Steiner & Zahlbr.) Gynelik
19. Apothecial disc chestnut, up to 1.5 mm. in diameter; ascospores 7-8 \times 6 μ ; spermatia 5-6 \times 0.6-0.7 μ ; thallus lobes 2 mm. wide, conspersa green, drying deep olive buff; sparsely rhizinoe below..... *P. conspersula* Nyl.

20. Underside dark fuscous to black.....21
20. Underside red brown, margins stramineous yellow; lobes 1-2 mm. wide, transversely rugose and rimose below, tips multifid, nearly terete; rhizinae on distal portions of lobes; apothecia 6-8 mm. in diameter, substipitate, margin inflexed; Cape of Good Hope.....*P. leonora* v. *multifida* Fw. 30
20. Underside pale, pale ochraceous or pale fuscous.....22
21. Medulla K-, C-; corticole or muscicole.....26
21. Medulla K yellow; terricole or saxicole; S. Africa.....26
21. Medulla K yellow then red, C-, KC rose to red.....28
22. Sterile; thallus conspersa green, black margined, lobes 0.25 mm. wide; underside fuscous black, rhizinae very few, 1-2 mm. long, black; muscicole.....*P. eradicata* Gyelnik 23
22. Fertile.....23
23. Ascospores under 7 μ long.....24
23. Ascospores over 11 μ long; belong in *Amphigymnia*.....25
24. Apothecia 1-2.5 mm. in diameter; ascospores $6.5-7 \times 3.25-3.5 \mu$; disc chestnut; underside black, sparsely verrucose, rhizinae not seen; thallus reed yellow, lobes irregularly dichotomous; medulla KC-; Mauritius.....*P. Wightii* Dodge 24
24. Apothecia 2 mm. in diameter; ascospores $7 \times 5 \mu$; disc auburn; underside black, minutely rugulose, rhizinae scattered; thallus deep olive buff, lobes subpinnate; medulla KC red; Angola.....*P. benguelensis* (Vainio) Dodge 25
25. Apothecia 2-6 mm. in diameter; ascospores $12-16 \times 6-8 \mu$; disc pale flesh to pale yellow; South Africa.....*P. amplexa* Stirton 25
25. Apothecia 7-9 mm. in diameter; ascospores $11 \times 6 \mu$; disc chestnut; underside black with buckthorn brown margins, nude of rhizinae in the outer 3 mm.; Portuguese East Africa; belongs in *Amphigymnia*.....*P. inbaminensis* Dodge 26
26. Disc chalky pruinose; lobes 2 mm. wide, rounded, yellow green; medulla C-, KC red; apothecia 2 mm. in diameter, margins thick, radially verrucose; ascospores $10-12 \times 8 \mu$; corticole; Tanganyika.....*P. glaucopsis* (Müll. Arg.) Vainio 27
26. Disc not pruinose even when young.....27
27. Lobes variable in width, white reticulate; medulla C-, KC red; underside very sparsely rhizinoze; apothecia 5 mm. in diameter, margins thick, coarsely crenate; ascospores $11-14 \times 6-8 \mu$; saxicole; cape of Good Hope.....*Omphalodium hypoleium* Nyl. 27
27. Lobes 0.5-4 mm. wide, yellow green; medulla C-, KC red; underside sparsely rhizinoze, lobes transversely cracked, subareolate in the center, black margined; saxicole; South West Africa.....*P. Schenckiana* Müll. Arg. 27
27. Lobes 1.5-2 mm. wide, white reticulate, yellow; medulla C-, KC red; rhizinae few and short; saxicole; Cape of Good Hope.....*P. hypoleioides* Vainio 27
27. Lobes pale sulfur stramineous, pinnate or crenate incised; apothecia up to 1 mm. in diameter; ascospores $9-11 \times 3-4 \mu$; spermatia $7 \times 0.5 \mu$; saxicole; Transvaal.....*P. saxeti* Stzbgr. 27
28. Lobes subcylindric, 0.25-0.5 mm. in diameter, densely imbricate, conspersa green; rhizinae rare; sterile; Madagascar.....*P. Benjovitzkyana* Gyelnik 28
28. Lobes wider, flat.....29
29. Ascospores $7-10 \times 5.5-6 \mu$; apothecia 3-5 mm. in diameter; lobes multifid, convex, 0.3-1.2 mm. wide; saxicole over mosses; S. Africa.....*P. synestia* Stirton 29
29. Ascospores $6.5-9 \times 5-6 \mu$; apothecia 1.5 mm. in diameter, lobes $30 \times 1-3$ mm.; sulfur to ashy stramineous; spermatia $5-6 \times 0.5 \mu$; S. Africa.....*P. subflabellata* Steiner 29
29. Ascospores $8-10 \times 6-7 \mu$; apothecia 7 mm. in diameter; lobes 2-5 mm. wide, ultimate lobules 1-2 mm. wide; terricole; Cape of Good Hope.....*P. stenotera* (Stirton) Dodge 29
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PARMELIA (XANTHOPARMELIA) ENDOMILTODES Nyl. in Crombie, Jour. Linn. Soc. Bot. 15:168. 1876.

Parmelia conspersa v. *endomiltodes* Müll. Arg., Flora 74:378. 1891.

Type: Cape of Good Hope, Table Mt., saxicole, A. E. Eaton, Venus Transit Exp.

Thallus 3-8 cm. in diameter, caespitose, growing over other thalli and covering much larger areas, citrine drab to deep olive buff, lobes about 6 mm. long, 2.5-3 mm. wide below, subflabellate, ultimate lobules 1-1.5 mm. long, 0.4-0.6 mm. wide, branching dichotomous with rounded sinuses, very imbricate, irregularly arranged not radiating at the margin, peripheral lobes closely attached to the rock, central lobes probably suberect, surface smooth, subnitid; underside black usually to the margins of the lobules, occasionally lighter at the margins, densely covered with short, simple rhizinae; upper cortex about 12 μ thick, of thickwalled fastigate pseudoparenchyma, protoplasts about 1 μ in diameter, more deeply staining and nubilated with brownish granules in the lower half (covered with collapsed longitudinal hyphae, probably the remains of a mold, 6-8 μ thick); algal layer 30 μ thick, continuous or nearly so, cells 5-6 μ in diameter, occasionally penetrating the upper medulla; medulla K yellow ferruginous, C-, KC deep orange ferruginous in the white portions, K orange red, C bleached to rose, KC very deep orange ferruginous with an evanescent deep violet shade in the rose to cinnabar portions, 210-220 μ thick, rather loosely woven, closer and more longitudinal in the lower

40 μ , hyphae 3 μ in diameter, relatively thinwalled; lower cortex 15 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 3 μ in diameter.

Apothecia 2 mm. in diameter, cupulate, margin thick, entire, inrolled, exciple smooth; disc burnt sienna; amphithecial cortex 30 μ thick, of fastigate pseudoparenchyma, protoplasts about 2 μ in diameter; algal layer 30 μ thick, continuous, cells 8–9 μ in diameter; medulla loosely woven, hyphae heavily nubilated in the middle third; algal layer under the parathecium 40 μ thick, continuous, cells 8–10 μ in diameter; parathecium 20 μ thick, of fastigate pseudoparenchyma, protoplasts 2.5 μ in diameter, more deeply staining above; hypothecium 30 μ thick, of slender, moderately thickwalled periclinal hyphae, deeply staining above and below with a hyaline zone in the middle about 8 μ thick; thecium 40 μ tall; paraphyses slender, septate, unbranched or occasionally once or twice dichotomous above the asci, tips not thickened, reaching the surface of the brownish epithelial gel; asci clavate 30 \times 10–11 μ , 8-spored, tip only slightly thickened when young; ascospores ellipsoid, 8–10 \times 6 μ .

CAPE OF GOOD HOPE: Table Mt. saxicole, A. E. Eaton, Venus Transit Exp. at Kew, a portion of the type collection; without definite locality, T. Cooper det. *P. conspersa* var. *endomiltodes* Müll. Arg. by Müller-Argau at Kew.

PARMELIA (XANTHOPARMELIA) ENDOCHRYSEA (Müll. Arg.) Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Parmelia adpressa v. *endochrysea* Müll. Arg., Flora 62:289. 1879.

Type: Congo, Nyam Nyam, Bendo, Gumango, *Schweinfurth*; Mt. Baginse, on gneiss, *Schweinfurth*.

Thallus 8–9 cm. in diameter, deep olive buff to wood brown, peripheral lobes about 10 mm. long, 4–5 mm. broad, some rounded, shallowly crenate, others more deeply lobed with rounded to excised sinuses, imbricate, central lobes slightly smaller but similar, surface smooth to slightly impressed and rugose, reticulate rimulose; isidia not abundant, simple, up to 0.5 mm. long, abundant on a few central lobes, rare on most; underside opaque, black to the margin or shading to chestnut and subnitid; rhizinae covering the whole underside, moderately dense, short, slender, simple, several uniting to form small disciform holdfasts in contact with the rock; upper cortex 10 μ thick, of gelified fastigate pseudoparenchyma, protoplasts about 1 μ in diameter, not nubilated; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla white, becoming deep orange in large areas, white areas K slowly yellow then rapidly orange red, C–, KC rapidly yellow then orange red, 35 μ thick, of moderately closely woven longitudinal hyphae, looser next the algal layer and the lower cortex, very heavily nubilated with grayish granules; lower cortex 15 μ thick, brownish, gelified, pseudoparenchymatous from longitudinal hyphae; rhizinae about 40 μ in diameter, formed by outgrowth of hyphae from the lower cortex.

Apothecia immature, about 0.5 mm. in diameter, ureceolate, margin crenulate, inrolled, exciple smooth; not sectioned.

As I have not seen Müller-Argau's types, the identification of our specimen is somewhat uncertain. The orange areas in our specimen are rather extensive and if Müller Argau had specimens from such portions of the thallus, our material

agrees with his description. The orange red color seems to be associated with moribund parts of the thallus.

CONGO: Kahusi, 2700 m., growing over mosses, F. L. Hendrickx 4307 in the E. African Herb.

PARMELIA (*XANTHOPARMELIA*) *ADPLANTA* Müll. Arg., Flora 68:502. 1885.

Type: Zanzibar, near Mombasa, on sandstone, J. M. Hildebrandt 1962 p. p.

Thallus probably 4 cm. in diameter, between lichen green and deep lichen green, lobes about 10 mm. long, 1 mm. wide, irregularly dichotomous below, subpinnate above with acute to rounded sinuses, ultimate lobes 1 mm. wide and long, rounded, tips sometimes nearly truncate, surface smooth, subnitid, cortex and algal layer easily cracking away, exposing the medulla; underside black, densely rhizinose ("subtus subpallidae" apparently from an upturned lobe where the lower cortex had scaled away), buckthorn brown, reticulate rugulose, nude in the outer 1.5 mm.; upper cortex 12 μ thick, of fastigate pseudoparenchyma, cells 4 μ in diameter, very heavily nubilated with dark brownish granules; algal layer of close discrete colonies of *Trebouxia* 15 μ in diameter, cells 4–5 μ in diameter; medulla warm buff, K rufescent, C–, KC slowly rufescent, 100 μ thick, upper 30 μ of moderately closely woven longitudinal hyphae 3 μ in diameter, heavily nubilated with brownish granules, the rest arachnoid, of oblique and subvertical hyphae with large air spaces; lower cortex 10 μ thick, of two layers of isodiametric cells 4–5 μ in diameter, very thickwalled, lumina about 2 μ , outer layer dark brown, inner layer hyaline.

ZANZIBAR: near Mombasa, on sandstone, J. M. Hildebrandt 1962 p. p. a portion of the type collection, at Kew.

Var. *isidiigera* (Müll. Arg.) Dodge, comb. nov.

Parmelia adplanta f. *isidiigera* Müll. Arg., Flora 68:502. 1885.

Parmelia isidiigera Vainio, Mem. Herb. Boissier 6:6. 1900.

Type: Zanzibar, near Mombasa, on ferriferous sandstone, J. M. Hildebrandt 1962 p. p.

Central portion of thallus densely isidiose, isidia 0.4 mm. long, mostly simple, rarely dichotomous; otherwise as in the type of the species.

ZANZIBAR: near Mombasa, on ferriferous sandstone, J. M. Hildebrandt 1962 p. p. at Kew, portion of the type collection.

PARMELIA (*XANTHOPARMELIA*) *bipindensis* Dodge, sp. nov.

Type: Cameroun, Bipinde, in primaeval forest, corticole, G. Zenker 4053 p. p. min. at Kew.

Thallus foliosus, laevis, citrino-ravus, marginibus olivaceo-alutaceis, lobis 10 \times 2 mm., pinnatim ramosis, revolutis, centro bullatus, multis cum spermogoniis, subtus alutaceo-brunneus, reticulatim rugosus, rhizinis pallidis; cortex superior 25–30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6–7 μ diametro; stratum algarum 20–25 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C evanescenter aurantiaca, KC–, dilute flavida, 250 μ crassi-

tudine, hyphis verticalibus, laxe contextis, 3-4 μ diametro, nubilatis; cortex inferior brunneus, 16-20 μ crassitudine, pseudoparenchymatice fastigiatus.

Apothecia sessilia, imperforata, 4-5 mm. diametro, marginibus crenatis, involutis, disco brunneo umbrinove; cortex amphithecialis 30 μ crassitudine; stratum algarum 45-50 μ crassitudine, coloniis discretis; medulla laxa sed densior quam in thallo; stratum algarum sub parathecio 30 μ crassitudine, continuum, nubilatum, cellulis 7-8 μ diametro; parathecium 25 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis 2 μ diametro; hypothecium 50 μ crassitudine, hyphis periclinalibus; thecium 55-60 μ altitudine; paraphyses tenues, apicibus non incrassatis; asci clavati, 45-50 \times 12-13 μ , apicibus subincrassatis; ascospores octonae, ellipsoideae, 6.5 \times 4 μ , episporio crasso.

Thallus foliose, smooth, center citrine drab, margins olive buff, marginal lobes 10 \times 2 mm., pinnately branched, very revolute, central portion bullate with many spermogonia (giving the appearance of a pseudostromata of a *Pertusaria*); underside buffy brown with very pale rhizinae, reticulately rugose and minutely scrobiculate; upper cortex 25-30 μ thick, of fastigate pseudoparenchyma, cells 6-7 μ in diameter; algal layer 20-25 μ thick, of discrete colonies and single cells of *Trebouxia*, cells 6-7 μ in diameter; medulla pale lemon yellow, K-, C evanescent orange, KC-, 230 μ thick, of loosely woven, predominantly vertical hyphae, 3-4 μ in diameter, heavily nubilated with brownish granules, especially in the axils of the hyphal branches; lower cortex brownish, 16-20 μ thick, of fastigate pseudoparenchyma.

Apothecia sessile, imperforate, 4-5 mm. in diameter, margin coarsely crenate, involute, exciple smooth, disc Brussels brown to raw umber; amphithecial cortex 30 μ thick, of fastigate pseudoparenchyma, cells 6-7 μ in diameter; algal layer 45-50 μ thick, of discrete colonies with occasional cells deep in the medulla; medulla loosely woven but much denser than the thalline medulla, heavily nubilated under the subparathecial algal layer; algal layer under the parathecium 30 μ thick, continuous, cells 7-8 μ in diameter, heavily nubilated with minute brownish granules; parathecium 25 μ thick, of fastigate pseudoparenchyma, protoplasts 2 μ in diameter; hypothecium 50 μ thick, of slender periclinal hyphae; thecium 55-60 μ tall; paraphyses slender, tips not thickened, ending in the brownish epithelial gel; asci clavate, 45-50 \times 12-13 μ , tips slightly thickened; ascospores short ellipsoidal, 6.5 \times 4 μ , with a rather thick episore.

The arrangement of the hyphae in the hypothecium suggests that the thecium is formed by many ascogonia, in one section the thecium from a single ascogonium appears to be about 250 μ in diameter.

CAMEROON: Bipinde, in primaeval forest, corticole, *G. Zenker 4053* p. p. min., type, at Kew.

ANGOLA: Maiombe, Chilungo, corticole, *J. Gossweiler*, at Kew.

PARMELIA (XANTHOPARMELIA) *Taylori* Dodge, nom. nov.

Parmelia mutabilis Taylor, London Jour. Bot. 6:171. 1847 non Fr.
Omphalodium mutabile Minks, Mém. Herb. Boiss. 21:86. 1900.

Type: Cape of Good Hope, Uitenhage, saxicole, *Zeyher 5*, ex Hooker Herb. in Taylor Herb. at Farlow Herb.

Thallus at least 4 cm. in diameter, probably larger, lobes variable, some up to 3 mm. broad and long, more about 1 mm. wide and up to 4 mm. long, the longer irregularly dichotomous, tips truncate to rounded, one thallus between citrine drab and dark olive buff, the other between citrine drab and buffy brown (after more than a century in the herbarium), very narrowly black margined; underside dark fuscous brown, paler toward the margin which appears nude (Taylor describes as "nigrovillosis" but the type is so closely glued to the herbarium sheet that the rhizinae are not visible); upper cortex 20 μ thick, outer 3 μ amorphous, below which is a layer of fastigate, cylindrical cells $10 \times 4 \mu$, walls gelified, covered with minute deep brown granules, the lower 7 μ of isodiametric cells 4 μ in diameter, apparently from periclinal hyphae but somewhat irregularly arranged; algal layer 15–20 μ thick, of discrete colonies of *Trebouxia*, cells 5–6 μ in diameter, partly subcontinuous; medulla chamois to deep colonial buff, nearly olive ochre in thick sections, a little paler next the lower cortex, K slowly orange, C slowly orange, KC–, 100–150 μ thick, arachnoid in the upper 20 μ with large air spaces, the rest very densely woven becoming more longitudinal in the lower 20 μ , hyphae about 4 μ in diameter, very heavily nubilated with pale brownish granules; lower cortex fastigate, 13–15 μ thick, lumina 1 μ in diameter, highly gelified; rhizinae 50–60 μ in diameter formed by outgrowth of the lower cortex.

Apothecia up to 3 mm. in diameter, sessile, margin at first entire becoming crenate, incurved, exciple smooth, disc rufous becoming deep auburn; amphithecial cortex 40 μ thick, fastigate, hyphae 6–7 μ in diameter, protoplasts 1 μ ; algal layer 35 μ thick, of discrete colonies; medulla deep orange; algal layer under the parathecium 65–70 μ thick, continuous except under the margin; parathecium 40 μ thick, fastigate, hyphae 6–7 μ in diameter, protoplasts 1 μ ; hypothecium 15 μ thick, of slender periclinal hyphae, deeply staining; thecium 35 μ tall; paraphyses conglutinate, septate, tips slightly clavate, brownish; asci broadly clavate, about $33 \times 13 \mu$, thickwalled, tips slightly thickened, 8-spored; ascospores broadly ellipsoidal, $8 \times 5 \mu$, with a thin episore.

Glued to the sheet with the type in Taylor's herbarium are two other thalli from Uitenhage, *Zeyher* 22 and 66, but neither seems to have contributed characters to Taylor's original description. I do not understand Taylor's phrases "gemmis marginalibus" and "demum gemmis crenulato." Taylor usually uses "gemma" in the sense of soredia, or perhaps isidia, while here it seems to refer to small lobules which he usually calls "propagula." Tuckerman identified all three as *P. conspersa* with a note "varying no little in South Africa." If Müller Argau borrowed the type sheet, he did not annotate it.

CAPE OF GOOD HOPE: Uitenhage, saxicole, *Zeyher* 5, ex Hooker Herb. in Taylor Herb. at Farlow Herb., type; Simon's Bay, saxicole, *Charles Wright*, North Pacific Exploring Exp. in Tuckerman herb. sub *P. conspersa*, at Farlow Herb.

PARMELIA (XANTHOPARMELIA) DJALONENSIS des Abb., Bull. Inst. Franç. Afrique Noire 13:966. 1951.

Type: Guinée Française, Fouta-Djalon à Dalaba (cercle de Mamou), 1200 m., on trunk of *Panara excelsa*, H. des Abbayes.

Thallus up to 10 cm. in diameter, stramineous yellow (between dark olive buff and deep olive buff in our Nigerian specimens about 100 years old), marginal lobes 20–25 mm. long, 1–2.5 mm. wide, irregularly subpinnate from irregular dichotomies with short internodes, sinuses rounded, surface smooth, dull, K yellow; central lobes shorter, very irregular, densely isidiose, isidia slender, mostly simple, black tipped, some dichotomous or coralloid, quite fragile, margins smooth, eciliate, sometimes isidiose; underside black, verrucose or rugose; rhizinae sparse in the center, denser on the peripheral lobes and lobules, almost erhizinose at the margin, very short, ending in subspheric holdfasts; cortex 15 μ thick, of fastigate pseudoparenchyma, relatively thinwalled, slightly nubilated with brownish granules; algal layer 30 μ thick, of close colonies, nearly continuous, cells 7–8 μ in diameter; medulla K–, C pink (faint and developing slowly in our specimens), KC–, 80 μ thick, of predominantly longitudinal, moderately closely woven hyphae, looser in the lower half, 3–4 μ in diameter, not nubilated; lower cortex about 20 μ thick, pseudoparenchymatous, cells about 7 μ in diameter, with thick, dark brown walls.

Apothecia up to 5 mm. in diameter, sessile, cupulate becoming flattened, margin entire at first, soon minutely crenulate and short isidiose; exciple densely short isidiose, disc cinnamon rufous becoming chestnut brown in age; amphithecial cortex 40 μ thick, of very thinwalled, fastigate pseudoparenchyma, protoplasts about 2 μ in diameter; algal layer of a few scattered colonies, 30 μ in diameter; medulla very loosely woven and easily tearing on sectioning; algal layer under the parathecium about 40 μ thick, continuous, cells very closely packed; parathecium 40 μ thick, of small-celled, fastigate pseudoparenchyma, the hyphae much less conglutinate than in the amphithecial cortex; hypothecium 25 μ thick, of periclinal thinwalled hyphae 2 μ in diameter; thecium 55 μ tall; paraphyses septate, dichotomous above the asci, branches submoniliform, tips not thickened, ending about 6 μ below the surface of the brown epithelial gel; asci cylindric-clavate, 32–35 \times 8 μ , wall thin; ascospores ellipsoid, 10–13 \times 5–6.5 μ .

The Uganda specimen has much shorter, less dense isidia and the marginal lobes are shorter and somewhat narrower, but it agrees microscopically with the Nigerian material.

NIGERIA: Charles Barter 1434; Nupe, Charles Barter, both corticole from Niger Exp. at Kew.

UGANDA: Kibango, 1290 m., on bark of *Albizzia Brownei*, R. Dümmer 602, at Kew.

PARMELIA (XANTHOPARMELIA) Gyelniki Dodge, nom. nov.

Parmelia conspersa v. *hypoclysta* f. *isidiosa* Müll. Arg., Flora 66:47. 1883.

Imbricaria conspersa v. *hypoclysta* f. *isidiosa* Jatta, Nuovo Giorn. Bot. Ital. N. S. 9:470. 1902.

Parmelia ambigua v. *isidiosa* Gyelnik, Ann. Mus. Nat. Hung. 30:125. 1936.

Type: Réunion, *Lepervanche*, com. Bornet.

Thallus 12–13 cm. in diameter, olive buff, peripheral lobes 35 mm. long, 7 mm. wide, margins crenate, twice or thrice dichotomous, ultimate lobes 6 mm. long, 2–3 mm. wide, sinuses excised, tips rounded, narrowly black margined, surface transversely rimose, faintly white reticulate, subverrucose with dense groups of

coralloid isidia 110 μ in diameter, up to 1 mm. tall, smooth, subnitid and irregularly rimulose on the ultimate lobes; underside ochraceous tawny to buckthorn brown, shining, with scattered groups (1–2 mm. in diameter) of dense branched rhizinae, margins nude for 1–2 mm.; upper cortex 30 μ thick, of fastigate pseudoparenchyma, cells 3 μ in diameter, upper half heavily nubilated with brownish granules; algal layer 30–40 μ thick, nearly continuous, cells 6 μ in diameter; medulla K yellow with a narrow zone turning red next the algal layer, C–, KC yellow then red, 65–80 μ thick, of thickwalled longitudinal hyphae 4 μ in diameter, very closely woven in the upper 40 μ , looser below and arachnoid with large air spaces next the lower cortex; lower cortex brownish, 15 μ thick, of gelified fastigate pseudoparenchyma, cells 6 μ in diameter, lumina about 1.5 μ .

Spermogonia developing at the top of the algal layer, oblate spheroid, 135 μ in diameter, 90 μ tall; still quite immature.

Apothecia with isidiose exciple, not seen.

CAPE OF GOOD HOPE: det. *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. by Müller Argau at Kew.

PARMELIA (XANTHOPARMELIA) XANTHINA (Müll. Arg.) Vainio, Etude Lich. Brésil 1:37. 1890.

Parmelia proboscidea v. *xanthina* Müll. Arg., Flora 67:616. 1884.

Parmelia perlata v. *xanthina* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9:156. 1890.

Parmelia xanthina f. *isidiosa* Müll. Arg., Hedwigia 30:229. 1890.

Type: Madagascar, without locality, J. M. Hildebrandt.

Thallus at least 5 cm. in diameter, dark olive buff in the center, shading to olive buff at the margins, yellower when wet, lobes rounded, 10–12 mm. wide, 5–10 mm. long, deeply crenate, margins smooth, narrowly black, or minutely dentate, ciliate, cilia up to 1 mm. long, surface subscrobiculate to minutely rugulose, densely isidiose in the center, less so on the peripheral lobes, isidia slender, coralloid; underside black, densely rhizinose, some margins with a nude border 1 mm. wide, others minutely papillate to the margin; rhizinae slender, simple or branched, black; upper cortex 15 μ thick, of fastigate, thinwalled pseudoparenchyma, cells 3–4 μ in diameter, heavily nubilated with minute brownish granules; algal layer 15 μ thick, of close discrete colonies of *Trebouxia*, cells only 3–4 μ in diameter, a few cells deeper in the medulla; medulla K–, C–, KC–, 50 μ thick, of moderately closely woven dichotomous hyphae, predominantly longitudinal but many transverse hyphae also present, somewhat nubilated with hyaline granules; lower cortex 12–13 μ thick, of fastigate pseudoparenchyma, lumina 1 μ in diameter, hyaline next the medulla, shading to very dark brown on the outside; rhizinae about 30 μ in diameter formed from the lower cortex.

While the habit suggests the *Subflavescentes* of *Amphigymnia*, the distribution of rhizinae on the underside clearly places it in *Xanthoparmelia*.

MADAGASCAR: Imerina, Andrangolaoka, terricole (quartz grains attached to rhizinae), growing over hepatics, J. M. Hildebrandt, Nov. 1880 ex herb. Sbarbaro at Farlow Herb.; Amboisha Prov., Mt. Ambohisamehary (Montagne de Dieu), 280–300 m., saxicole, *Savelle* 6, ex herb. E. C. Paris.

CAPE OF GOOD HOPE: probably near Somerset East, *P. MacOwan* sub *P. Perlata* v. *ciliata* f. *aspera* Müll. Arg. det. Müll. Arg. at Kew.

PARMELIA (XANTHOPARMELIA) subhypoclysta Dodge, sp. nov.

Type: Madagascar, Imerina, Andrangolaoka, saxicole or terricole (quartz grains adherent to underside), *J. M. Hildebrandt*, sub *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. ex Sbarbaro Herb. at Farlow Herb.

Thallus ad 6 cm. diametro, aquose viridis K flavescens, lobis ca. 15 mm. longitudine, inferne 3–4 mm. latitudine, irregulariter dichotomis, internodis brevibus, subpinnatis, sinibus rotundatis, lobulis ultimis ca. 2 mm. longitudine, 1 mm. latitudine, apicibus rotundatis; isidia subverrucosa aut breviter cylindrica, non ramosa, tenuia, in lobis centralibus densa, periphericis sparsiora, non in lobulis ultimis nec marginibus; inferne umbrinus aut argillaceus aut cinnamomeo- aut roseo-alutaceus, subnitidus, lobis aliis nudis reticulato rugulosis, alteris verrucosis rhizinosisque; cortex superior 9–10 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 3 μ diametro, granulis brunneis nubilatus; stratum algarum 30 μ crassitudine, cellulis 6–7 μ diametro sparsis; medulla K–, C–, KC–, 80 μ crassitudine, hyphis longitudinalibus 3 μ diametro dense contextis, irregulariter granulis griseo-brunneis nubilatis; cortex inferior 12 μ crassitudine, fastigiatus, hyphis pachydermeis, 2 μ diametro, lumina sphaerica, 1 μ diametro.

Thallus up to 6 cm. in diameter, water green, K slowly yellow, lobes about 15 mm. long, 3–4 mm. wide below, irregularly dichotomous, with short internodes, subpinnate, sinuses rounded, narrowing at each dichotomy, ultimate lobules about 2 mm. long, 1 mm. wide, tips rounded, truncate or retuse; isidia from verrucose to short cylindric, not branched, slender, dense on the central portions, more scattered toward the periphery, absent from the ultimate lobules and never marginal; underside varying from Saccardo's umber to clay color, cinnamon buff or pinkish buff, subnitid, some lobes nude, reticulate rugulose, more often verrucose with occasional rhizinae growing out from the verrucae; upper cortex 9–10 μ thick, of fastigate, thinwalled pseudoparenchyma, cells about 3 μ in diameter, very heavily nubilated with brownish granules; algal layer 30 μ thick, continuous, cells 6–7 μ in diameter, not closely packed, between vertical medullary hyphae; medulla K–, C–, KC–, 80 μ thick, of closely woven longitudinal hyphae 3 μ in diameter, heavily but irregularly nubilated with grayish brown granules; lower cortex 12–13 μ thick, fastigate, of thickwalled hyphae about 2 μ in diameter, lumina spherical, 1 μ in diameter.

This species differs from *P. Gyelniki* Dodge in longer, narrower lobes, darker underside and in chemical inactivity of the medulla. *Parmelia Gyelniki* has a medulla K yellow, C–, KC rose.

MAURITIUS: without locality nor collector, herb. Hookerianum at Kew.

MADAGASCAR: Imerina, Andrangolaoka, saxicole or terricole, (quartz grains adherent to underside), *J. M. Hildebrandt* sub *P. conspersa* v. *hypoclysta* f. *isidiosa* Müll. Arg. ex Sbarbaro Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) MOZAMBICA Vainio, Bol. Soc. Broter. II. 6:145. 1929-30.

Type: Portuguese East Africa, Palma, Moçimba da Paria, *Americo Pires de Lima 454, 460, 948, 954*; Ponta Vermelha, *Pires de Lima 931, 944*, all corticole.

Thallus up to 5.5 cm. in diameter, between cream buff and dark olive buff, K yellow, becoming dirty greenish as the solution dries, peripheral lobes about 20 mm. long, 2 mm. wide, subpinnate with excised sinuses, ultimate lobules about 1 mm. long, about 1 mm. wide, some much narrower, tips rounded, rarely truncate; underside black, a little lighter at the margins; rhizinae covering the whole underside, dark brown, mostly short and simple; upper cortex 15 μ thick, of fastigate, thinwalled pseudoparenchyma, cells 5–6 μ in diameter; algal layer 20 μ thick, of very close colonies of *Trebouxia* in a nearly continuous layer, cells 7–8 μ in diameter, tending to be arranged in vertical rows between medullary hyphae; medulla K– or pale yellow, C–, KC–, about 40 μ thick, of predominantly longitudinal hyphae, moderately closely woven, heavily nubilated with hyaline granules; lower cortex 10 μ thick, of fastigate pseudoparenchyma, cells about 3 μ in diameter, relatively thinwalled and only slightly brownish in sections; rhizinae about 25 μ in diameter, formed by the outgrowth of the hyphae of the lower cortex, but the hyphae are conglutinate and the walls thicker.

KENYA: Machakos, collector not given, no. 28, at Kew.

TANGANYIKA: *Braun 8601* ex B. L. Inst. Amani, E. African Herb.

NORTHERN RHODESIA: Abercorn, growing over orchid roots on trees, *A. A. Bullock 1395* p. p. min., International Red Locust Control Service, at Kew.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, at Kew.

PARMELIA (XANTHOPARMELIA) njalensis Dodge, sp. nov.

Type: Sierra Leone, Kori, Njala, on bark of *Funtumia africana*, *F. C. Deighton M5642* at Kew.

Thallus 4 cm. diametro, viridis, membranaceus, 55–60 μ crassitudine, lobis 3–4 mm. longitudine, ad 1 mm. latitudine, irregulariter dichotomis aut subpinnatis, sinibus rotundatis excisique, lobuli ultimi 0.3 mm. longitudine, 0.5 mm. latitudine, apicibus truncatis retusisve, marginibus laevibus, superne laevis, nitidus, paucis cum isidiis papilliformibus in centro thalli; inferne niger, rhizinis nigris ramosis, 30 μ diametro tereta; cortex superior 11–12 μ crassitudine, fastigiatus, cellulis 6 μ diametro; stratum algarum 20 μ crassitudine, continuum, cellulis 6–7 μ diametro; medulla K–, C evanescenter rosea, KC–, 15–20 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense intertextis; cortex inferior 8 μ crassitudine, brunneus, hyphis longitudinalibus 2 μ diametro, luminibus 1 μ diametro.

Thallus about 4 cm. in diameter, between Vetiver green and tea green, membranous, only 55–60 μ thick, peripheral lobes 3–4 mm. long, up to 1 mm. wide below, irregularly dichotomously to subpinnately branched, with rounded to excised sinuses, ultimate lobules up to 0.3 mm. long and 0.5 mm. wide, tips truncate to retuse, margins smooth with rhizinae showing beyond the edge as a pseudohypothallus; upper surface smooth, shining with a very few slender, short, papilliform isidia in the center of the thallus; underside black, densely covered with branched black rhizinae about 30 μ in diameter; upper cortex 11–12 μ thick, fastigate of about two layers of isodiametric cells 6 μ in diameter; algal layer 20 μ thick, continuous, cells 6–7 μ in diameter with an occasional cell pushing up between the cortical cells or down into the medulla; medulla K–, C evanescent pink, KC–, 15–20 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter;

lower cortex $8\ \mu$ thick, of longitudinal hyphae $2\ \mu$ in diameter, brownish, protoplasts about $1\ \mu$ in diameter, growing down to form the rhizinae.

SIERRA LEONE: Kori, Njala, on bark of *Funtumia africana*, F. C. Deighton M5642 at Kew.

PARMELIA (XANTHOPARMELIA) DECARYANA Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 36:153. 1934.

Type: Comoro Islands, Anjouan (Johana) Island, Tsantsani, corticole, R. Decary, ex herb. Paris.

Thallus 6–7 cm. in diameter, deep olive buff to olive buff, K dirty yellowish green, peripheral lobes about 10 mm. long, 1.5 mm. wide, repeatedly dichotomous, not conspicuously narrower at each dichotomy, ultimately lobules 1–3 mm. long, about 1 mm. wide, tips mostly truncate or retuse, sides nearly parallel, sinuses rounded, surface smooth, subnitid; underside black in the center, shading to hazel at the ultimate lobules, minutely reticulate rugulose, rhizinae in small dense groups, varying from papillae to short, slender rhizinae, ultimate lobules nude; upper cortex $15\ \mu$ thick, of fastigiate thinwalled pseudoparenchyma, protoplasts $3\ \mu$ in diameter, outer $3\ \mu$ an amorphous gel; algal layer $30\ \mu$ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 6–7 μ in diameter; medulla K yellow, then orange red, becoming ferruginous as the solution dries, C–, KC similar to K reaction but paler, $95\ \mu$ thick, of predominantly longitudinal hyphae, closely woven, $3\ \mu$ in diameter, heavily nubilated with minute hyaline granules throughout; lower cortex 10 – $12\ \mu$ thick, deep brown, of fastigiate pseudoparenchyma, rather thicker walled than the upper cortex.

Apothecia up to 1.5 mm. in diameter (immature) cupulate, margin crenate, inrolled, exciple smooth, substipitate, disc auburn; amphithecial cortex $15\ \mu$ thick, similar in structure to the upper cortex but not covered by an amorphous layer; algal layer $30\ \mu$ thick, of discrete colonies; medulla densely woven and heavily nubilated; algal layer under the parathecium $30\ \mu$ thick, continuous; parathecium $30\ \mu$ thick, gelified, fastigiate; hypothecium $20\ \mu$ thick, of slender thinwalled, periclinial hyphae, moderately closely woven; thecium $55\ \mu$ tall; paraphyses septate, once or twice dichotomous above the asci, tips slightly clavate, nearly reaching the surface of the brownish epithecial gel; asci clavate, wall about $2\ \mu$ thick, tip somewhat thicker, protoplast mamillate, $40 \times 12\ \mu$; ascospores ellipsoid, $6 \times 3\ \mu$ (immature?).

Thomas 615 has more slender ultimate lobules and is sterile.

KENYA: Machakos, 1930 m., collector not given, no. 28, 1906 at Kew.

UGANDA: Elgon, Madangi, 3550 m., on rocks in alpine meadow, A. S. *Thomas 615*; Bugishu, Buginyanya, 2100 m., on rocks, A. S. *Thomas 466*, Sese, Towa forest on rocks in grassland, 1225 m., A. S. *Thomas 3030*; all at Kew.

PARMELIA (XANTHOPARMELIA) *Wildeae* Dodge, sp. nov.

Type: St. Helena, Mrs. Wilde, in herb. Hookerianum at Kew.

Thallus 12 cm. diametro aut major, olivaceo-alutaceus, lobis periphericis tenuiter nigromarginatis, 10 mm. longitudine, ad 1 mm. latitudine, irregulariter

dichotomis, sinibus rotundais, lobulis ultimis 1 mm. longitudine, ca. 0.5 mm. latitudine, apicibus truncatis, lobis centralibus ca. 3 mm. longitudine, 0.3–0.5 mm. latitudine, imbricatissimis; soralia ad 1 mm. diametro, hemisphaerica, granulosa, superficialia, neque terminalia neque subterminalia; inferne cinnamomeus argillaceusve, opacus, rhizinis nigro-brunneis aut nigris, brevibus; cortex superior 16 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, subsphaericis, 8 μ diametro, granulis obscure brunneis nubilatis; stratum algarum coloniis discretis, 20 μ diametro, cellulis ad 8 μ diametro; medulla K flavo-rubescens, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense contextis nubilatisque; cortex inferior 20 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 6 μ diametro, luminibus ca. 1 μ diametro, pachydermeis, gelifactisque. Apothecia non visa.

Thallus over 12 cm. in diameter, probably much larger, olive buff, peripheral lobes 10 mm. long, up to 1 mm. wide, mostly narrower, irregularly dichotomous, sinuses rounded, ultimate lobules 1 mm. long, about 0.5 mm. wide, tips truncate; central lobes very irregularly arranged, about 3 mm. long, 0.3–0.5 mm. wide, very imbricate, all narrowly black margined; soralia up to 1 mm. in diameter, hemispheric, granular, superficial, neither terminal nor subterminal on the lobules; underside cinnamon buff to clay color, opaque, rhizinae dark brown to black, in small dense groups, short; upper cortex 16 μ thick, of fastigate pseudoparenchyma, cells nearly spherical, 8 μ in diameter, thinwalled, very heavily nubilated by dark brown granules; algal layer of discrete colonies of *Trebouxia*, 20 μ in diameter, cells up to 8 μ in diameter; medulla K yellow then red, C–, KC–, 65 μ thick, of longitudinal hyphae 3 μ in diameter, very closely woven and so heavily nubilated that the structure is obscure in thicker sections; lower cortex 20 μ thick, of fastigate pseudoparenchyma, hyphae 6 μ in diameter, very thickwalled and gelified, lumina about 1 μ in diameter. Apothecia absent.

ST. HELENA: *Mrs. Wilde*, in herb. Hookerianum at Kew.

PARMELIA (XANTHOPARMELIA) CONSPERSULA Nyl. in Crombie, Jour. Bot. Brit. For. 14:19. Jan. 1876; Jour. Linn. Soc. Bot. 15:168. July 1876.

Type: Cape of Good Hope, Table Mt., *A. E. Eaton*, saxicole, Venus Transit Exp.

Thallus at least 4 cm. in diameter, conspersa green when fresh, between deep olive buff and avellaneous (1957), center rimose areolate but cracks not reaching the lower cortex, areoles polygonal, about 1 mm. in diameter, black margined, peripheral lobes about 2 mm. wide, irregularly dichotomous below, subpinnate above, sinuses rounded, ultimate lobules 0.5–1 mm. wide, tips rounded or crenate; underside black slightly rugulose, rhizinae not dense, very short, holding the thallus closely to the stone; upper cortex 15 μ thick, fastigate, cells thinwalled, 15 \times 7.5 μ , very heavily nubilated with brownish granules; algal layer from subcontinuous to scattered discrete colonies of *Trebouxia*, 30 μ in diameter, cells 6 μ in diameter; medulla K yellow then ferruginous or reddish, C–, KC ferruginascent to reddish, 80 μ thick, of closely woven longitudinal hyphae 2.5 μ in diameter, very heavily nubilated with grayish granules, loosely woven under the ridges below;

lower cortex dark brown, 8 μ thick, of about two layers of nearly isodiametric cells, extending to the top of the lobes at the margins.

Apothecia 1.5–2.5 mm. in diameter, margins entire, slightly inflexed, exciple smooth, disc chestnut, imperforate; amphithecial cortex 40 μ thick, of gelified fastigate pseudoparenchyma, protoplasts about 2 μ in diameter, somewhat nubilated with brownish granules; algal layer of large discrete colonies, 40 μ in diameter, with much smaller colonies between; medulla loosely woven; algal layer under the parthecium 30 μ thick, continuous; parathecium 45–50 μ thick, of small celled pseudoparenchyma, probably fastigate, but cells somewhat irregularly arranged; hypothecium 15 μ thick, of very slender, closely woven periclinial hyphae; thecium 55 μ tall; paraphyses slender, closely septate, simple or once dichotomous above, tips slightly clavate, reaching the surface of the brownish epithecial gel; asci cylindric, about $55 \times 8 \mu$, 8-spored, relatively thinwalled; ascospores ellipsoid, $7-8 \times 6 \mu$, with a moderately thick epispore.

Spermatia sub-bifusiform, $5-6 \times 0.6-0.7 \mu$, fide Nylander.

CAPE OF GOOD HOPE: without locality or collector, Herb. Hookerianum at Kew (lower left plant).

PARMELIA (XANTHOPARMELIA) LEONORA Sprengel in Mass., Mem. I. R. Ist. Veneto Sci. Lett. Arti 10:51. 1861.

Parmelia leonora v. *platyphylla* Sprengel in Fw., Linnaea 17:29. 1843, nom. nud.

Parmelia conspersa v. *Leonora* Lindsay, Trans. R. Soc. Edinburgh 22:233. 1859, nom. nud.

Type: Cape of Good Hope, Drège 64, Wawra also cited by Massalongo.

Thallus at least 7 cm. in diameter, tawny olive to clay color, shining, lobes irregularly dichotomous, 1–3 mm. wide, some internodes long and branches resemble a stag horn, other internodes short and tips with 4–6 digitate lobules, sinuses rounded, not excised, some margins microphylline, surface smooth, transversely rimose toward the bases of the lobes, eciliate; underside Brussels brown or darker, shining, minutely rugose; rhizinae stout in small groups with a terminal whorl of short branches forming the holdfasts; upper cortex 60 μ thick, of fastigate pseudoparenchyma, cells thinwalled, 10 μ in diameter, 20 μ long, somewhat shorter next the outer surface, heavily nubilated with brownish granules in the upper 20 μ ; algal layer 35 μ thick, continuous, cells 7–8 μ in diameter between vertical medullary hyphae but not filamentous; medulla K yellow, C–, KC–, 115 μ thick, of longitudinal hyphae heavily nubilated with grayish granules except in the lower 15 μ ; lower cortex black, 15 μ thick, inner cells spherical 10 μ in diameter, outer cells 4 μ in diameter, thickwalled, irregularly arranged.

Apothecia subpedicellate, up to 5 mm. in diameter, urceolate, margins crenulate, inrolled, exciple smooth shining to rugulose, disc burnt sienna to chestnut, remaining concave; amphithecial cortex 50–60 μ thick, fastigate, gelified of very thickwalled hyphae; algal layer 50 μ thick, continuous, cells closely packed; medulla loosely woven; algal layer under the parathecium 30 μ thick, cells closely packed; parathecium 50 μ thick, of fastigate pseudoparenchyma, hyphae somewhat dichotomous above, very thickwalled, gelified; hypothecium 20 μ thick, of closely woven, slender, periclinial hyphae, deeply staining; thecium 55 μ tall; paraphyses

slender, tips clavate, ending about $5\ \mu$ below the surface of the brownish epithecial gel; asci clavate, $30 \times 10\ \mu$, walls thin, tips thickened, 8-spored; ascospores ellipsoid, falsely bilocular, ellipsoid, $7 \times 3\ \mu$.

On the same sheet is glued another plant, more greenish yellow of similar habit, but lobes much narrower, not studied microscopically.

CAPE OF GOOD HOPE: without locality, *Breutel* ex hb. R. B. van den Bosch in Tuckerman Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) *Wightii* Dodge, sp. nov.

Type: Mauritius, saxicole ?, *Robert Wight*, in Taylor Herb. sub *P. conspersa* at Farlow Herb.

Thallus plus quam 6 cm. diametro flavidus, nigricans, lobis imbricatis, ad 2 mm. latitudine, irregulariter dichotomis, sinibus rotundatis, lobulis ultimis ca. 1×0.5 mm., laevibus, anguste nigromarginatis; inferne niger, subrugulosus, sparsim verrucosus, rhizinis raris nigris, ca. 0.5 mm. longitudine; cortex superior $40\ \mu$ crassitudine, fastigiatus, cellulis $6\ \mu$ diametro; stratum algarum $30\ \mu$ crassitudine, coloniis discretis *Trebouxiae*, cellulis $6-7\ \mu$ diametro; medulla K-, C-, KC-, $65-100\ \mu$ crassitudine, hyphis longitudinalibus laxae intertextis; cortex inferior niger, $13-16\ \mu$ crassitudine, cellulis $6\ \mu$ diametro.

Apothecia 1-2.5 mm. diametro, margine crenulato, excipulo subimpresso, disco subconcavo planove, castaneo; cortex amphithecialis $35-40\ \mu$ crassitudine, fastigiatus; stratum algarum $20\ \mu$ crassitudine, subcontinuum; medulla arachnoidea, hyphis granulis griseis nubilitis; stratum algarum sub parathecio $45\ \mu$ crassitudine, continuum; parathecium $25\ \mu$ crassitudine, pseudoparenchymatice fastigiatum; hypothecium $10\ \mu$ crassitudine, hyphis tenuibus periclinialibus laxae intertextis; thecium $50\ \mu$ altitudine; paraphyses tenues, semel dichotomae sub apicibus incrassatis; asci late clavati $22 \times 13\ \mu$, pachydermei, apicibus incrassatis; ascospores octonae, ellipsoideae, $6.5-7 \times 3.25-3.5\ \mu$, false biloculares.

Thallus more than 6 cm. in diameter, probably much larger, reed yellow on a few more or less sheltered lobes, mostly blackened (appearing to be a *Melaenoparmelia* at first sight), lobes very imbricate, the peripheral lobes very variable in outline, 2 mm. or less wide, irregularly dichotomous, sinuses rounded, ultimate lobules about 1 mm. long, 0.5 mm. wide, smooth, very narrowly black margined; underside black, very slightly rugose and sparsely verrucose, rhizinae very rare, black, about 0.5 mm. long (most of the thallus glued tightly to the herbarium sheet); upper cortex $40\ \mu$ thick, outer $10\ \mu$ fastigiate, heavily nubilated with greenish brown granules, the rest hyaline, irregularly fastigiate of thinwalled pseudoparenchyma, the cells about $6\ \mu$ in diameter; algal layer $30\ \mu$ thick, of close discrete colonies of *Trebouxia*, cells $6-7\ \mu$ in diameter; medulla K-, C-, KC-, $65-100\ \mu$ thick, of loosely woven predominantly longitudinal hyphae; lower cortex black, $13-16\ \mu$ thick, of two layers of large celled pseudoparenchyma, cells about $6\ \mu$ in diameter, the outer layer black, the inner layer brown.

Apothecia abundant, 1-2.5 mm. in diameter, margin crenulate, exciple slightly

impressed, disc subconcave to plane, chestnut; amphithecial cortex 35–40 μ thick, of the same structure as the thalline cortex; algal layer 20 μ thick, nearly continuous; medulla arachnoid, (tearing badly on sectioning), hyphae heavily nubilated with grayish granules; algal layer under the parathecium 45 μ thick, continuous; parathecium 25 μ thick, of fastigate very thickwalled pseudoparenchyma, the upper half more deeply staining; hypothecium 10 μ thick, of very loosely woven slender periclinal hyphae; thecium 50 μ tall; paraphyses slender, septate, once dichotomous below the very slightly enlarged tip, reaching the surface of the epithelial gel; asci broadly clavate, $22 \times 13 \mu$, wall 2 μ thick, tip 4 μ , with truncate protoplast, 8-spored; ascospores ellipsoid, falsely bilocular, $6.5\text{--}7 \times 3.25\text{--}3.5 \mu$.

MAURITIUS: probably saxicole, *Robert Wight* in Taylor Herb. sub *P. conspersa* at Farlow Herb., type; herb Hookerianum without collector at Kew; Ponce Range, saxicole, *P. B. Ayres* at Kew; Round Island, hill 290 m., saxicole, *Henry Halero Johnson* 27, 29, at Kew.

PARMELIA (XANTHOPARMELIA) *benguellensis* (Vainio) Dodge, comb. nov.

Parmelia subconspersa v. *benguellensis* Vainio, Cat. Welwitsch African Pl. 2:401. 1901.

Type: Angola, Benguela, Huilo, 1225–1775 m., Mt. Morro de Lopollo, *Welwitsch* 31 p. p.; Serra de Chella, *Welwitsch* 30, both corticole.

Thallus deep olive buff, lobes $6\text{--}7 \times 1.5\text{--}2$ mm., dichotomous with short internodes, appearing subpinnae, sinuses rounded to slightly excised, tips rounded to retuse; underside black to the margin, shining, very minutely rugulose, sparingly rhizinose, rhizinae several times dichotomous near the base, up to 1.5 mm. long; upper cortex 15 μ thick, fastigate, hyphae 5–6 μ in diameter, very thickwalled, outer half nubilated with brownish granules; algal layer 15 μ thick, continuous or partly of discrete colonies 15 μ in diameter, cells 6 μ in diameter; medulla K–, C–, KC–, 30–35 μ thick, of thickwalled longitudinal hyphae, 3 μ in diameter, moderately closely interwoven, with an occasional air space under the algal layer and quite compact below; lower cortex black, 15–18 μ thick, of conglutinate, closely septate, longitudinal, relatively thinwalled hyphae 5–6 μ in diameter.

Apothecia short stipitate, superficial, about 2 mm. in diameter, margin crenate, splitting into about 5 sectors, exciple smooth, disc auburn; amphithecial cortex 23–26 μ thick, similar to the thalline cortex but nubilated only in the outer 9 μ ; algal layer 25 μ thick, of close but discrete colonies; algal layer under the parathecium similar but a little thinner; parathecium 30–35 μ thick, similar to the thalline cortex but the outer cells somewhat larger with spherical protoplasts; hypothecium 7–10 μ thick, of periclinal, very slender hyphae, tending to tear away from the parathecium; thecium 45 μ tall; paraphyses slender, often once dichotomous above the asci, tips slightly clavate ending in the brownish epithelial gel, 10 μ thick asci 8-spored, cylindric clavate, $33 \times 11 \mu$, thickwalled with thickened tips; ascospores subdistichous, thickwalled, short ellipsoidal, $7 \times 5 \mu$.

FERNANDO PO: Santa Isabel Peak, 2575 m., corticole, *Gustavo Mann*, herb. W. A. Leighton at Kew.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, corticole, at Kew.

PARMELIA (XANTHOPARMELIA) GLAUCOPIS (Müll. Arg.) Vainio, Mém. Herb. Boissier 5:4. 1900.

Parmelia caperata v. *glaucoptis* Müll. Arg., Bot. Jahrb. [Engler] 20:258. 1894.

Type: Tanganyika: Usambara, Matangiri, Mgogo, corticole, *Stuhlmann* 359.

Thallus at least 4 cm. in diameter, between light grape green and tea green, peripheral lobes 10 mm. long, 1.5–2 mm. wide, irregularly dichotomous, contiguous, narrowly black margined, about 1.5 mm. wide at the fork, expanding to 2–3 mm. wide at the next dichotomy, surface low verrucose, tips rounded, central lobes very imbricate and lobulose; underside black, densely short rhizinoae, rhizinae ending in circular holdfasts about 0.3 mm. in diameter, attaching the thallus very closely to the bark; upper cortex 30 μ thick, of fastigate pseudoparenchyma, cells 4 μ in diameter, very heavily nubilated with brownish granules; algal layer 30 μ thick, nearly continuous, cells closely packed, 6–8 μ in diameter; medulla K yellow, C–, KC faint yellow, 103–135 μ thick, hyphae very densely woven in the thinner areas, looser in the thicker areas, about 6 μ in diameter with very thin lumina, very heavily nubilated with grayish granules; lower cortex black, about 40 μ thick, of fastigate pseudoparenchyma, cells about 6 μ in diameter.

Apothecia up to 2 mm. in diameter, margin thick, incurved, exciple radially sulcate, subverrucose, disc concave to finally nearly plane, chalky pruinose when young, the pruina more or less weathering away when old; amphithecial cortex 20 μ thick at the margin, expanding to 40 μ thick below, of fastigate pseudoparenchyma, heavily nubilated with brownish granules; algal layer 20 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium 20 μ thick, cells closely packed in a continuous layer; parathecium 55 μ thick, of fastigate pseudoparenchyma, extending beyond the amphithecial cortex to the top of the thecium; hypothecium 15 μ thick, of slender, thinwalled deeply staining, periclinal hyphae; thecium about 60 μ tall; paraphyses slender, closely septate, twice or thrice dichotomous above the asci, tips clavate, about 4 μ in diameter, nearly reaching the surface of the dark brown epithelial gel; asci clavate, 60 \times 11 μ , tip thickened, protoplast short mamillate when young; ascospores ellipsoid, 10–12 \times 8 μ , with a moderately thick episore.

TANGANYIKA?: (E. Tropical Africa between 2° and 7° S.), corticole, *J. Hannington* det. *P. caperata* v. *caperatula* Nyl. by Müller Argau, probably before he described *P. caperata* v. *glaucoptis*.

PARMELIA (XANTHOPARMELIA) HYPOLEIODES Vainio, Ann. Univ. Aboensis A 2:3:1. 1926.

Type: South Africa, near Paarl, saxicole, *Miss van Velden*, com. P. A. van der Bijl 334.

Thallus about 5 cm. in diameter, pale olive buff at the margins, darker in the center; center areolate diffract, many areoles narrowly black margined, but no hypothallus developed; marginal lobes 3–6 mm. long, 1–3 mm. wide below, once or twice dichotomous, sinuses acute or rounded, ultimate lobules 1–1.5 mm. wide, 1–2 mm. long, tips truncate or nearly so, narrowly brown margined, surface

smooth, slightly convex, closely adherent to the rock, not even the ultimate lobules free; underside black, rhizinae very short 0.3 mm. long, dense, with large holdfasts; upper cortex 12 μ thick, of fastigiate, thinwalled pseudoparenchyma, cells about 2 μ in diameter, heavily nubilated with brownish granules; algal layer of close, discrete colonies of *Trebouxia*, 20–25 μ in diameter, forming an almost continuous layer, cells 6–7 μ in diameter; medulla K– or yellow, C–, KC yellow then red, 50 μ thick, the upper half loosely woven of vertical hyphae, the lower half of closely woven longitudinal hyphae 3 μ in diameter; lower cortex black, a single layer of isodiametric cells, very thickwalled 5–6 μ in diameter extending up the side and over the upper surface for 130 μ ; rhizinae 70 μ in diameter.

CAPE OF GOOD HOPE: Cape Prov., Paarl District, on quartz pebble, com. *P. A. van der Bijl* 99 ex G. K. Merrill Herb. at Farlow Herb.

PARMELIA (XANTHOPARMELIA) SYNESTIA Stirton, Trans. Glasgow Soc. Field Nat. 5:214. 1877.

Type: S. Africa, Cave Mt., on mossy stones, *J. H. McLea*.

Thallus about 8 cm. in diameter, citrine drab to olive buff, lobes 1–3 mm. wide, 20–30 mm. long, irregularly dichotomous and subpinnate, tips slightly rounded, truncate or retuse, sinuses rounded, surface smooth at first becoming minutely reticulate rimulose in the older portions; underside black, densely rhizinose in contact with the moss, rhizinae slender, unbranched, otherwise black papillate, with ultimate lobes often smooth and shining; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 4–5 μ in diameter, very heavily nubilated in the outer half; algal layer 15 μ thick, continuous, cells 6–7 μ in diameter; medulla K yellow then red, C–, KC yellow then red, white becoming deep orange red in moribund portions, 150 μ thick, of very densely woven slender hyphae, somewhat less so just under the algal layer and next the lower cortex; lower cortex black, 30 μ thick, of thickwalled fastigiate pseudoparenchyma growing out to form the rhizinae 80 μ in diameter.

Apothecia 3 (–12) mm. in diameter, substipitate, margin inflexed, entire to minutely crenulate, exciple smooth, subnitid, disc concave, amber brown; amphithecial cortex 40 μ thick, of fastigiate pseudoparenchyma, hyphae 6 μ in diameter, only slightly nubilated with brownish granules; algal layer of colonies 30 μ in diameter, close and nearly continuous; medulla loosely woven, somewhat nubilated with grayish granules next the algal layers; algal layer under the parathecium 40 μ thick, continuous, cells closely packed above, more scattered below; parathecium 45 μ thick, of fastigiate pseudoparenchyma, protoplasts about 3 μ in diameter; hypothecium 30 μ thick, of moderately closely woven thinwalled periclinial hyphae 2 μ in diameter; thecium 45 μ tall; paraphyses septate, once dichotomous above the asci, branches moniliform, tips slightly clavate, ending 8–10 μ below the surface of the very pale brownish epithelial gel; asci cylindric clavate, about 30 \times 8 μ , 8-spored, tips thickened when young; ascospores ellipsoid, 7–10 \times 5.5–6.5 μ , with a moderately thick episore.

Thomas 626 has narrower, more irregular lobes, approaching those of *P. Benyovskiyana* Gyelnik in size, but distinctly flattened, and larger apothecia, up to 12 mm. in diameter, but it agrees with *P. synestia* Stirton microscopically.

CAPE OF GOOD HOPE: without locality or collector, Herb. Hookerianum at Kew; Transvaal, near Lydenburg, saxicole, *F. Wilms* 2753, at Kew.

TANGANYIKA: Kilimandjaro, muscicole, *R. G. Turrall* 70a, ex E. African Agr. Res. Sta. Amani, at Kew.

UGANDA: Mt. Elgon, Masaba, 4550 m., on stones in alpine meadow, *A. S. Thomas* 626, at Kew.

PARMELIA (*XANTHOPARMELIA*) *stenotera* (Stirton) Dodge, comb. nov.

Parmelia phaeophana v. *stenotera* Stirton, Trans. Glasgow Soc. Field Nat. 5:215. 1877. for further description of type, see Gyelnik, Ann. Mus. Nat. Hungar. Bot. 31:36. 1938.

Type: Cape of Good Hope, Somerset East, terricole, *P. MacOwan*.

Thallus covering areas at least 17×12 cm., lobes so irregularly arranged and imbricate that it is difficult to make out individual thalli, pale Veronese green, primary lobes 10–20 mm. in diameter nearly circular, margins sinuate, crenate or dentate, some growing out as irregularly dichotomous secondary lobes about 2–3 mm. wide, of variable lengths, the ultimate lobules about 0.5 mm. wide, sometimes appearing digitate when the upper internodes are very short; underside black, sometimes clay color on the lobules, shining; rhizinae very dense throughout, short, black, 0.2–0.3 mm. long, branched at the tips; upper cortex 25μ thick, fastigate from dichotomous hyphae arising from medullary hyphae passing up through the algal layer, protoplasts about 2μ in diameter, the outermost 6μ decomposed into an amorphous hyaline gel, not nubilated; algal layer 45μ thick, continuous above, cells more widely spaced below, 6μ in diameter; medulla K yellow then red, C–, KC yellow then red, 135μ thick, white becoming orange red where moribund, of predominantly longitudinal hyphae 2μ in diameter, thinwalled, moderately closely woven above, very loosely so in the lower third; lower cortex black, 15μ thick, subfastigate, imbedded in a deep brown gel.

Apothecia 6–7 mm. in diameter, sessile on primary lobes and nearly covered by secondary lobes of adjacent thalli; margin thin, minutely crenulate, exciple irregularly concentrically rugulose, disc plane, imperforate, burnt sienna or darker; amphithecial cortex 25μ thick, fastigate, hyphae 3μ in diameter, protoplasts isodiametric, about 1μ in diameter, very heavily nubilated with brownish granules; algal layer partly continuous, 40μ thick, partly of widely spaced discrete colonies, 30 – 40μ in diameter, with lacunae between as if the algae had died and disintegrated; medulla very thick, arachnoid in the outer half, somewhat more closely woven next the algal layer below the parathecium which is 30 – 40μ thick, continuous; parathecium 30μ thick, of fastigate pseudoparenchyma; hypothecium 30μ thick, of slender, thinwalled deeply staining periclinal hyphae; thecium 45μ tall; paraphyses slender, branching above the asci, branches submoniliform, tips not or very slightly thickened, ending about 5μ below the surface of the brownish epithelial gel; asci cylindric, 8-spored, about $30 \times 8 \mu$, tip thickened when young; ascospores 8 – 10×6 – 7μ , with a thin episore.

TANGANYIKA: Kilimanjaro, 4610 m., *H. H. Johnston* 21 det. *P. conspersa* v. *laxa* Müll. Arg. by Müller Argau at Kew; Bismarck-Peters, 3570 m., on volcanic rock in alpine meadows above temperate rain-forest, *R. G. Turrall* 70 at Kew.

PARMELIA (*XANTHOPARMELIA*) *Zenkeri* Dodge, sp. nov.

Type: Cameroun, Bipinde, in primaeval forest, corticole, *G. Zenker 4053*, in Dodge Herb. and at Kew.

Thallus 10–12 cm. diametro, olivaceous brunnescent; lobis latitudine variabilibus, lobulis ultimis $4-7 \times 2-3$ mm.; inferne pallide brunneo-olivaceus, rugosus, rhizinis albidis, densis; cortex superior 25μ crassitudine, fastigiatus, gelifactus, luminibus 1μ diametro; stratum algarum ad 30μ crassitudine, partim coloniis discretis *Trebouxiae*, partim continuum; medulla alba, K-, C-, KC-, 200μ crassitudine, subarachnoidea, hyphis pachydermeis, 3μ diametro; cortex inferior $16-17 \mu$ crassitudine, fastigiatus, gelifactus, dimidia parte externa amorphus.

Apothecia sessilia, 3–4 mm. diametro, margine integro subcrenatove, disco cinnamomeo-rufo dein castaneo-brunneo; cortex amphithecialis 35μ crassitudine; strata algarum $16-20 \mu$ crassitudine; parathecium 35μ crassitudine, fastigiatum, ad 50μ crassitudine ad latera thecii; hypothecium 35μ crassitudine, hyphis periclinalibus dense contextum; thecium 80μ altitudine; paraphyses tenues, apicibus clavatis; asci clavati, $65 \times 9 \mu$, apicibus non incrassatis; ascospores ellipsoideae, $6 \times 4 \mu$ (immaturae?).

Thallus 10–12 cm. in diameter, drying ecru olive to dark olive buff at the margins, center finally buffy brown to olive brown, lobes variable in width, ultimate lobes $5-7 \times 2-3$ mm., sinuses slightly or not excised; underside light brownish olive at the margin, brownish olive toward the center, rhizinae white, dense except a narrow nude margin on some lobes, not on others, branched in the outer half, tips forming a small disc holdfast in contact with the substrate, surface very rugose and subscrobiculate; upper cortex 25μ thick, fastigiate, gelified, lumina about 1μ in diameter; algal layer up to 30μ thick, partly continuous, partly of discrete colonies of *Trebouxia*, $20-25 \mu$ in diameter; medulla white, K-, C-, KC-, 200μ thick, hyphae thickwalled, 3μ in diameter, very loosely woven to almost arachnoid, more closely woven under the algal layer; lower cortex $16-17 \mu$ thick, fastigiate, gelified, the outer half amorphous.

Apothecia sessile, 3–4 mm. in diameter, margin entire to slightly crenate, disc cinnamon rufous to hazel, finally chestnut brown; amphithelial cortex 35μ thick, fastigiate, gelified, lumina 1μ in diameter; algal layer $16-20 \mu$ thick both next the cortex and under the parathecium; parathecium 35μ thick below the hypothecium, expanding to 50μ thick at the top of the thecium, of conglutinate, thick-walled fastigiate hyphae; hypothecium 35μ thick, of closely woven, periclinial hyphae; thecium 80μ tall; paraphyses slender, terminal cell clavate ending $7-8 \mu$ below the surface of the brownish epithelial gel; asci stipitate clavate, 8-spored, $65 \times 9 \mu$, stipe 40μ long, tip not conspicuously thickened; ascospores short ellipsoid, about $6 \times 4 \mu$, still in the ascus and probably immature.

CAMEROUN: Bipinde, in primaeval forest, corticole, *G. Zenker 4053*, type, in Dodge Herb. and at Kew.

PARMELIA (*XANTHOPARMELIA*) *Eylesii* Dodge, sp. nov.

Type: Southern Rhodesia, Makoni District, Forest Hill Kop, in kloof, south aspect, little sun, on rock, 1595 m., *Frederick Eyles 832*, at Kew.

Thallus griseo-viridis, siccitate olivaceo-alutaceus, laevis, lobis ad $20 \times 3-5$ mm., dichotomis, sinibus subexcisis, apicibus retusis; inferne cinnamomeo-alutaceus, reticulatim rugosus, subscrobiculatusve, rhizinis nigris, brevibus, simplicibus; cortex superior, $20-25 \mu$ crassitudine, pseudoparenchymatice fastigiatus, protoplastis sphaericis, 4μ diametro, strato amorpho ad 7μ crassitudine tectus; stratum algarum ca. 35μ crassitudine, coloniis sphaericis discretis *Trebouxiae*, cellulis $9-10 \mu$ diametro; medulla K-, C-, KC-, 200μ crassitudine, strato superiore 65μ crassitudine compacto, granulis albidis nubilato, strato inferiore hyphis leptodermeis longitudinalibus, 6μ diametro; cortex inferior 30μ crassitudine, fastigiatus, gelifactus, brunneus.

Apothecia submarginalia, ad 6 mm. diametro, subpedicellata, margine integro dein crenato, excipulo laevi, disco castaneo; cortex amphithecialis superne 10μ , inferne 40μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 35μ crassitudine, evanescens; stratum algarum sub parathecio $16-23 \mu$ crassitudine, coloniis discretis; parathecium 25μ crassitudine, hyphis periclinalibus; hypothecium 10μ crassitudine, hyphis tenuibus intertextis; thecium 60μ altitudine; paraphyses tenues, simplices, apicibus non incrassatis; asci anguste clavati, $35 \times 7 \mu$; ascospores ellipsoideae, monostichae, subimbricatae, $7 \times 5 \mu$.

Thallus gray green when fresh, drying olive buff shading to deep olive buff at the center, smooth, lobes up to $20 \times 3-6$ mm., dichotomous, sinuses somewhat excised, tips retuse; underside cinnamon buff, reticulately rugose and subscrobiculate; rhizinae very few, short, simple, nearly black, mostly torn away in removing the thallus from the rock; upper cortex $20-25 \mu$ thick, of fastigate pseudoparenchyma, moderately thickwalled, protoplasts spherical 4μ in diameter, upper 7μ heavily nubilated with brownish granules, in places overlaid with a hyaline amorphous layer 7μ thick; algal layer about 35μ thick, of discrete spherical colonies of *Trebouxia*, cells spherical $9-10 \mu$ in diameter, sometimes in vertical rows between medullary hyphae but clearly not filamentous; medulla K-, C-, KC-, 200μ thick, the upper 65μ very compact and heavily nubilated with white granules, the rest of mostly longitudinal hyphae 6μ in diameter, relatively thinwalled, interlaced with transverse hyphae; lower cortex about 30μ thick, the outer 10μ brown, fastigate, highly gelified.

Apothecia submarginal, up to 6 mm. in diameter, subpedicellate, margin entire at first, then coarsely crenate, exciple smooth, disc chestnut; amphithecial cortex 40μ thick below narrowing to 10μ at the top of the thecium, of fastigate pseudoparenchyma, moderately thickwalled; algal layer of discrete spherical colonies, disappearing below where the cortex is completely hyaline; algal layer under the parathecium only $16-23 \mu$ thick, colonies more widely separated; parathecium 25μ thick, of three layers, the upper and lower layers of gelified periclinal hyphae, the middle layer of thinwalled periclinal pseudoparenchyma and more deeply staining; hypothecium 10μ thick, of very slender interwoven hyphae; thecium 60μ tall; paraphyses slender, unbranched, tips not thickened, ending at the base of the brownish epithelial gel, 10μ thick; asci narrowly clavate, $35 \times 7 \mu$; ascospores short ellipsoidal, monostichous, subimbricate, $7 \times 5 \mu$.

SOUTH AFRICA: Natal, Van Reenen, 1775 m., on stones, *M. Franks* com. I. M. Wood 12273, at Kew; Kentani District on exposed stones along streams, *Alice Pegler* 1229, at Kew.

SOUTHERN RHODESIA: Makoni District, 1550 m., on dead wood, *Frederick Eyles* 822; Forest Hill Kop, in kloof, south aspect, little sun, on rock, 1595 m., *Frederick Eyles* 832, type; both at Kew.

PARMELIA (XANTHOPARMELIA) CONCOLOR Sprengel, Syst. Veg. 4:2:328. 1827.

Type: Cape of Good Hope.

Thallus fragmentary, clay color to cinnamon buff, some central lobes rounded, 9 mm. wide, margin thick, sulcate, entire to slightly and coarsely dentate, recurved, surface very rugose and bullate, the bullae with immersed spermogonia (resembling the pseudostromata of *Pertusaria*), with apothecia along the folds; underside isabella color, lighter toward the margin; rhizinae isabella color, dense, very short, forming minute disc holdfasts with fimbriate margins; upper cortex 30 μ thick, the outer half completely gelified, amorphous, hyaline, the inner half of fastigiate pseudoparenchyma, cells cylindric, $10 \times 6 \mu$, heavily nubilated with greenish brown granules; algal layer 40 μ thick, of solitary cells 7–10 μ in diameter and small colonies of *Trebouxia* in a nearly continuous layer; medulla K-, C-, KC-, 225 μ thick, of intricately, moderately closely woven, thickwalled hyphae 5–7 μ in diameter, predominantly longitudinal, more loosely woven below, heavily nubilated in the upper 100 μ ; lower cortex 10 μ thick, of a single layer of very thickwalled pale yellowish hyphae, protoplasts spherical, 2.5 μ in diameter; rhizinae 60–65 μ in diameter, formed by the downgrowth of medullary hyphae, corticate with cells from the lower cortex.

Apothecia abundant, 5 mm. in diameter, margin thick, incurved, crenate, ex-ciple smooth, disc concave to plane, Brussels brown; amphithecial cortex 42–50 μ thick, fastigiate, gelified, (judging by the stained protoplasts, hyphae about twice dichotomously branched, the branches curving upward and soon parallel); algae disappearing under the amphithecial cortex, the very loosely woven medullary hyphae in contact with the cortex, slightly nubilated with grayish granules; algal layer under the parathecium up to 65 μ thick, of scattered cells and small colonies in a more or less continuous layer; parathecium 15 μ thick, of gelified, fastigiate pseudoparenchyma from dichotomy of medullary hyphae above the algal layer, deeply staining protoplasts about 2 μ in diameter; hypothecium 13 μ thick, of slender, closely woven, periclinal hyphae; thecium 50 μ tall; paraphyses slender, once dichotomous above, tips slightly clavate, ending near the surface of the brownish epithelial gel; asci clavate, 8-spored, about $40 \times 13 \mu$, wall thin, tips thickened, ascospores subspherical, $6-7 \times 5-6 \mu$.

CAPE OF GOOD HOPE: forests toward Grahamstown, corticole?, *Zeyher* 1 in Taylor Herb. sub *P. rugosa* Tayl., det. *P. conspersa* by Tuckerman, Farlow Herb.

PARMELIA (XANTHOPARMELIA) PHAEOPHANA Stirton, Trans. Glasgow Soc. Field Nat. 5:215. 1877.

Type: South Africa, Cape Province, Somerset East, terricole, *P. MacOwan*.

Thallus covering areas at least 9×5 cm., probably larger, very imbricate, center olive buff or darker, shading to olive buff on the marginal lobes, central lobes

up to 15 mm. long, 7–8 mm. wide, margins dentate to lobulate, lobules 2 mm. long, 1 mm. wide, tips rounded to truncate, very irregularly dichotomous with rounded sinuses, peripheral lobes similar but smaller and more irregular, narrowly black margined in the distal portions, surface subnitid, minutely white punctate or reticulate; underside tawny in the center, darker to Mars brown or almost black at the margins, subnitid, sparsely verrucose to papillate, a few papillae growing out as short concolorous rhizinae ending in a minute disciform holdfast; upper cortex 15 μ thick, of fastigiate pseudoparenchyma, cells 3–4 μ in diameter, very heavily nubilated with brown granules; algal layer 30 (–40) μ thick, continuous or nearly so, cells 6 μ in diameter; medulla K yellow, slowly red, C–, KC yellow, slowly red, 95–105 μ thick, of very densely woven thickwalled hyphae 4 μ in diameter, heavily nubilated throughout with grayish granules; lower cortex light brown in section, about 11 μ thick, of fastigiate pseudoparenchyma, protoplasts about 1 μ in diameter.

Apothecia 5–7 (–11) mm. in diameter on the central lobes, quite abundant, margins inflexed, crenate to crenulate, exciple smooth, disc bay or darker, imperforate, remaining concave; amphithecial cortex 15 μ thick, of fastigiate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 50 μ thick, continuous, cells up to 12 μ in diameter; medulla arachnoid; algal layer under the parathecium 40 μ thick, continuous, cells mostly 6–8 μ in diameter; parathecium 30 μ thick, of fastigiate pseudoparenchyma, protoplasts 2.5 μ in diameter, very deeply staining; hypothecium 25 μ thick, of slender, thinwalled periclinial hyphae; thecium 55 μ tall; paraphyses simple or dichotomous above the asci, tips not thickened, ending about 8 μ below the surface of the yellowish epithelial gel; asci cylindric, 8-spored, about $40 \times 8 \mu$, with thick walls and thicker tips when young; ascospores short ellipsoidal, $6-7 \times 5-5.5 \mu$ (perhaps immature, not seen free from the ascus), with a thick episore. Stirton records the ascospores as $8-10 \times 5-6 \mu$ in the original description.

NATAL: Drakenberg, *Felden*, det. *P. conspersa* v. *hypoclystoides* Müll. Arg. by Müller Argau, at Kew.

CAPE OF GOOD HOPE: Simon's Bay, Table Mt., north oak forest, over hepatics on stones, [*Breutel* ?*] 282, Dec. 1852, det. *P. conspersa* v. *hypoclysta* Nyl. by Müller Argau, at Kew.

SECT. HYPOTRACHYNA

Parmelia sect. *Hypotrachya* Vainio, *Etude Lich.* Brésil 1:58. 1890.

Parmelia subg. *Euparmelia* sect. *Hypotrachyna* Zahlbr. in Engler & Prantl, *Nat. Pflanzenfam.* I. 1*:212. 1907.

Type: *P. acanthifolia* Pers.

Thallus glaucous to gray, appressed or with the tips of the lobes ascendant, lobes varying from narrow, linear to broader and rounded; underside usually black, sometimes pale, rhizino-se to the margin or the submarginal rhizinae reduced to dark papillae or verrucae, rarely absent in the outer 1–2 mm.; medulla white (except stramineous in *P. madagascarensis*); apothecia sessile or substipitate, disc usually imperforate, rarely perforate; parathecium of fastigiate hyphae or pseudo-

* The only other collector I know of who may have been in this region at the time was Charles Wright, botanist of the U. S. North Pacific Exploring Expedition. In Tuckerman's publications of his lichens, I do not find any species of *Parmelia* sect. *Xanthoparmelia* listed, nor did I find a duplicate of this specimen in Tuckerman's herbarium at the Farlow Herb.

parenchyma (except in *P. insignata* with thickwalled periclinal hyphae); asci usually thinwalled with tips thickened when young, a few species having walls up to $2\ \mu$ thick (up to $3\ \mu$ in *P. decorata* and *P. ornata*); ascospores small to medium (up to $18\ \mu$ long, but over $22\ \mu$ long in *P. Menziesii*, *P. pachysperma* and *P. Schweinfurthii*). Spermatogonia of the usual type, immersed in the thallus, not in bullate prominences.

The problem of separation of species of sect. *Hypotrachyna* from *Xanthoparmelia* has been discussed on p. 52. Ordinarily separation from subg. *Amphigymnia* is no problem on account of the coarser, less dense rhizinae confined to the central portion of the thallus with broad nude zones at the margins of the lobes in the latter. In a few species of sect. *Hypotrachyna*, the margins are nude of rhizinae in a narrow zone up to 2 mm. wide and small marginal lobules may be wholly nude, while in subg. *Amphigymnia*, the nude zone at the margin is always 3 mm. wide, usually much wider.

1. Thallus isidiose, sometimes also sorediose (if only exciple isidiose see *P. Hanningtoniana* Müll. Arg. and *P. hypocraea* Vainio, no. 21 and no. 24 respectively in this key).....2
1. Thallus sorediose or pseudocyphellate but not isidiose.....11
1. Thallus margins microphylline, habit of *Lecanora* subg. *Squamaria* or a small *Physcia*; lobes 1 mm. wide, irregularly subpinnatifid, very convex, pulverulent at first; apothecia 1 mm. in diameter, disc fuscous, concave, ascospores $8-10 \times 6-7\ \mu$; South West Africa (see also *P. revoluta* v. *ambigua* no. 3 below).....*P. lecanoracea* Müll. Arg.
1. Thallus neither isidiose, sorediose or microphylline.....20
2. Isidia confined to margins; thallus pale ochroleucous, margins black ciliate; apothecia pedicellate, urceolate, 6-10 mm. in diameter, disc pale fuscous; ascospores $22-25 \times 12-15\ \mu$, very thick walled; ramulicole; Socotra.....*P. Schweinfurthii* Müll. Arg.
2. Isidia both marginal (minutely lobulate) and superficial; thallus pale glaucescent, rhizinae showing at the margin but not truly ciliate; medulla K-, C-; apothecia 2.5-6 mm. in diameter, disc rufous, margin entire to crenulate, without spermatogonia; ascospores $14-18 \times 9-12\ \mu$; Angola.....*P. coronata* v. *denudata* Vainio
2. Isidia superficial only.....3
3. Thallus isidio-scribulate, margins microphylline; habit of *P. saxatilis*; Tanganyika.....*P. revoluta* v. *ambigua* Stein
3. Isidia coralloid, at least in part.....4
3. Isidia wholly simple, mostly quite short.....6
4. Apothecia 13-20 mm. in diameter; pale below with pale rhizinae; surface rugulose, margin incised crenate to lacerate and almost isidioid; medulla K-, C pink, KC-; truncicole; Cape of Good Hope.....*P. pbricodes* (Stirton) Dodge
4. Apothecia smaller, 2-5 (-7) mm. in diameter.....5
5. Isidia slender, partly cylindric; lobes dichotomous, $15 \times 3-5$ mm.; medulla K yellow then red, C pale yellow, KC-; ascospores not developed; saxicole; Guinée.....*P. laevigatoides* des Abb.
5. Isidia 0.5-1 mm. long, subarticulate; lobes probably broad; medulla K yellow rufescent, KC red; ascospores $11-16.7 \times 7-9$ (-10) μ ; corticole; Cape of Good Hope.....*P. Junodii* Steiner
5. Isidia cylindric or branched; lobes more or less pinnate, 25×10 mm.; medulla K-, C-, KC-; ascospores $9-10 \times 5-6\ \mu$; saxicole; Madagascar to Réunion.....*P. meizoporoides* Dodge
6. Isidia forming soredia or soredia also present.....7
6. Isidia not forming soredia.....8
7. Thallus very rimulose, minutely and sparsely isidiose with chalky white soredia; corticole; Socotra.....*P. tiliacea* v. *rimulosa* Müll. Arg.
7. Thallus not rimulose, isidia small, breaking down as soredia; margins with subspheric glands, black; apothecia 1-2.5 mm. in diameter; ascospores $9-11 \times 6-7\ \mu$, thickwalled; medulla K yellow then red; corticole; Madagascar.....*P. subglandulifera* Hue
7. Thallus subreticulate rimulose, clay color, tips of lobes glaucous; soredia isidioid; apothecia 2-2.5 mm. in diameter; ascospores $8 \times 5\ \mu$; medulla K-, C-, KC-; South Africa.....*P. leptophylla* Müll. Arg.
8. Margins eciliate.....9
8. Margins ciliate.....10
9. Medulla K-, C-, KC very slowly yellow; apothecia 5 mm. in diameter; ascospores $10-12 \times 6-7\ \mu$; lobes $10 \times 3-5$ mm., subpinnate; truncicole; Angola.....*P. concrescens* Vainio
9. Medulla K yellow then orange red, C-, KC-; apothecia 2.5 mm. in diameter; ascospores $18.5 \times 8\ \mu$; ramulicole; Somaliland.....*P. Gilletti* Dodge

10. Margins microphylline, isidiose dissected, central portions more or less isidiose; medulla K-, C-, KC-; Tanganyika.....*P. subsidiosa* (Müll. Arg.) Dodge
10. Margins minutely isidiose; apothecia 2-5 mm. in diameter; ascospores $10-12 \times 6-8 \mu$; medulla K yellow ferruginascent, C pink fading, KC-; truncicole; Angola.....*P. isidiza* Nyl.
10. Margins not microphylline nor isidiose; lobes $5 \times 2-3$ mm., subpinnate; sterile; medulla K-, C-, KC-; corticole; Uganda.....*P. sublaevigatoides* Dodge
11. Medulla and subapical soredia stramineous, K yellow, C-; lobes 1-3 mm. wide, axils excised; muscicole; Madagascar.....*P. madagascariensis* Vainio
11. Medulla and soredia white.....12
12. Soredia small, punctate, probably pseudocyphellae.....13
12. Soredia on upper surface only; margins eciliate.....15
12. Soredia both superficial and marginal, margins short black ciliate, ends of lobes rounded, deeply crenate, margins lobulate sorediose; medulla K-, C-, KC-; terricole; Madagascar.....*P. foliolosa* Dodge
12. Soredia marginal, apical or confluent, sometimes spreading to the adjacent surface of the marginal lobes.....18
13. Cilia 1 mm. long, 3-4-fid; lobes pinnatifid; medulla sublutescent; black below; S. Africa.....*P. pilosa* Stzbgr.
13. Thallus not truly ciliate (rhizinae from underside bend outward and extend beyond the margin in *P. subaequans*, thus imitating cilia).....14
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31. Lobes 1-2.5 \times 0.1-1.2 mm.; apothecia 0.75-1 (-1.5) mm. in diameter; ascospores $6.5-10 \times 4.5-5.5 \mu$; medulla C and KC pink above; Transvaal.....*P. brachyphylla* Müll. Arg.
31. Lobes $20 \times 3-4$ mm.; apothecia 1-1.5 mm. in diameter (immature ?); ascospores $7-8 \times 5-5.5 \mu$; medulla C and KC-; corticole; Angola.....*P. ganguensis* Dodge
31. Lobes 3×2 mm.; apothecia 3 mm. in diameter; ascospores $10-13 \times 5-6 \mu$; medulla K very faint yellow, C-, KC-; ramulicole; Sierra Leone.....*P. Deightoni* Dodge

32. Lobes $30 \times 3-4$ mm.; apothecia 2.5-3 (-4) mm. in diameter, margin entire to subcrenulate, sessile, disc rufous; ascospores $8 \times 5.5 \mu$; medulla K yellow next the algal layer, rest negative, C-, KC-; Mt. Ruwenzori.....*P. Scottii* Vainio
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33. Habit of *P. quercina*; margins ciliate, lobes up to 3 mm. wide; medulla K yellow then red or orange red, C-, KC- becoming orange when moribund; sterile; on epiphytic roots; Uganda.....*P. orchidophila* Dodge
34. Thallus plumbeous; saxicole; Cape of Good Hope.....*P. molybdiza* Nyl.
34. Thallus pale glaucous, lobes 0.5-1 mm. wide; apothecia unknown; medulla K-, C and KC pink; corticole; Cape of Good Hope.....*P. suffixa* Stirtton
35. Habit of *P. conspersa* or *P. Mougeotii* but ashy white, lobes up to 6 mm. wide; saxicole; Cape of Good Hope.....*P. Mougeotii* v. *dealbata* Mass.
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PARMELIA (HYPOTRACHYNA) LECANORACEA Müll. Arg., Flora 71:529. 1888.

Type: South-West Africa, Great Namaland, A. Schenck 543.

Thallus citrine drab, lobes very imbricate, convex, irregular in the center with microphylline margins, lobules up to 0.5 mm. long, 0.2-0.3 mm. wide, irregular in shape; marginal lobes less imbricate, nearly plane, 10-15 mm. long, 2-3 mm. wide, irregularly dichotomous with short internodes, appearing subpinnae, ultimate lobules about 2 mm. long, 1 mm. wide, narrowly black margined, rimose in the older portions; underside black, with short black rhizinae, not very dense and nearly nude at the margins; upper cortex 22-32 μ thick, fastigiate, hyphae 5-6 μ in diameter, above heavily nubilated with brownish granules, more hyaline below; algal layer of discrete colonies of *Trebouxia*, cells 6 μ in diameter, with occasional cells deeper in the medulla; medulla K yellow, C-, KC faint yellow, 115-130 μ thick, of moderately closely woven, branched, predominantly longitudinal hyphae, very thickwalled, 4-5 μ in diameter; lower cortex 22-23 μ thick, very black, apparently pseudoparenchymatous from longitudinal hyphae, extending up the side of the lobe and joining the upper cortex near the margin above; rhizinae 55-60 μ in diameter, growing out of the lower cortex.

Apothecia up to 2 mm. in diameter, nearly sessile, margins entire and inrolled at first, becoming minutely crenulate and scarcely inrolled at maturity; exciple smooth, subnitid, very slightly sulcate near the margin, disc concave to nearly plane, Sanford's brown when moist, auburn or darker when dry; amphithecial cortex 40 μ thick, hyaline, fastigiate; algal layer of scattered discrete colonies; algal layer under the parathecium 20-25 μ thick, nearly continuous; parathecium 30-35 μ thick, similar to the thalline cortex but hyaline with larger protoplasts; hypothecium 30 μ thick, of thickwalled periclinal hyphae, hyaline below, more deeply staining above; thecium 50-55 μ tall; paraphyses slender, septate, once or twice dichotomous in the upper half, branches submoniliform, ending near the surface of the brownish epithelial gel; asci broadly clavate, $30 \times 10 \mu$, thick-walled with a greatly thickened tip, remaining so until the ascospores are nearly mature, 8-spored; ascospores distichous, $8-10 \times 6-7 \mu$, with a thick episore.

Our specimen agrees well with Müller Argau's description except in color (not pale ashy), the apothecia are up to 2 mm. in diameter instead of 1 mm. The

color of our thalli would suggest inclusion in *Xanthoparmelia* rather than in the *Hypotrachyna*. Another thallus from the same collection agrees with the above description except the color is almost isabella color with some ultimate lobules almost ecru olive; the apothecia are younger, not more than 1 mm. in diameter.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, corticole, J. Gossweiler, Com. 1910 at Kew (2 specimens).

PARMELIA (HYPOTRACHYNA) phricodes (Stirton) Dodge, comb. nov.

Parmelia laceratula v. *phricodes* Stirton, Trans. Glasgow Soc. Field Nat. 5:213. 1877.

Type: South Africa, Mt. Boschberg near Somerset East, truncicole, P. MacOwan.

Thallus at least 4 cm. in diameter, between tawny olive and wood brown (1957); peripheral lobes 15 mm. long, 5 mm. wide, dichotomous with rounded sinuses, tips crenate, sometimes lacerate, dentate to microphylline, lobules up to 1 mm. long, 0.2 mm. wide, surface smooth to slightly rugulose, central portion very densely isidiose, isidia slender, coralloid, up to 1 mm. long; underside warm buff or lighter; rhizinae dense, short, very pale; upper cortex 30 μ thick, gelified, of fastigate pseudoparenchyma, protoplasts 2–3 μ in diameter, somewhat irregularly arranged; algal layer 25 μ thick, continuous, cells 7–10 μ in diameter, mostly solitary, evenly spaced, occasionally in small colonies of a few cells each, occasionally interrupted for a space of 15 μ under the nongelified areas of the cortex (for aeration); medulla K–, C pink, KC–, up to 200 μ thick, hyphae loosely woven in the upper half, heavily nubilated with minute hyaline crystals, the lower half of closely woven, longitudinal hyphae; lower cortex very pale brown, gelified, of fastigate pseudoparenchyma, lumina about 1 μ in diameter; rhizinae 40–50 μ in diameter, of very slender, conglutinate hyphae without a cortical layer.

Apothecia 13–20 mm. in diameter, fide Stirton.

SOUTH AFRICA: Drège ex herb. Sonder sub *P. Borreri* Ach. f. in Tuckerman Herb. at Farlow Herb., sterile.

PARMELIA (HYPOTRACHYNA) LAEVIGATOIDES des Abbayes, Bull. Inst. Franç. Afrique Noire 13:970. 1951.

Type: Guinée Française, Fouta-Djalon à Dalaba (cercle de Mamou), 1200 m., saxicole, H. des Abbayes; Côte d'Ivoire, Mt. Tonkoni, (cercle de Man), 1100 m., saxicole, H. des Abbayes.

Thallus 6–10 cm. in diameter, citrine drab in the center, shading to olive buff on the peripheral lobes, subnitid; peripheral lobes up to 15 mm. long, 3–5 mm. wide, irregularly dichotomous with round to excised sinuses, ultimate lobules about 1 mm. long and wide, tips truncate; center isidiose, isidia cylindric, slender, concolor or tips darker, quite dense, rare or absent on the peripheral lobes; underside black, Dresden brown on the ultimate lobules, densely rhizinose throughout; upper cortex 15 μ thick, of thinwalled, fastigate pseudoparenchyma, cells 5 μ in diameter, heavily nubilated with grayish granules; algal layer about 20 μ thick, continuous, cells closely packed, 6–7 μ in diameter; medulla K yellow then red, finally ferruginous as the solution dries, C– or pale yellowish, KC–, 40 μ thick, very loosely

woven next the algal layer and the lower cortex, middle more closely woven, heavily nubilated with hyaline granules, hyphae mostly longitudinal, $3\ \mu$ in diameter; lower cortex $8\ \mu$ thick, a single layer of isodiametric cells; rhizinae $20\ \mu$ in diameter, formed by a strand of medullary hyphae pushing downward between the cortical cells.

Apothecia sessile, 2–5 (–7) mm. in diameter, margins entire, exciple isidiose, disc concave becoming nearly plane, imperforate, hazel to auburn; amphithecial cortex $55\ \mu$ thick, of fastigate, very thickwalled conglutinate hyphae, lumina $1\ \mu$ in diameter, apparently branched and anastomosing; algal layer of discrete colonies up to $30\ \mu$ in diameter, with some cells deeper in the medulla, tending to die out; algal layer under the parathecium $30\ \mu$ thick, nearly continuous; parathecium $25\ \mu$ thick, of fastigate pseudoparenchyma, protoplasts about $2\ \mu$ in diameter; hypothecium $15\ \mu$ thick, of thickwalled periclinal hyphae, conglutinate below and scarcely staining, deeply staining above; thecium $65\ \mu$ tall; paraphyses slender, septate, simple or dichotomous above the asci, terminal cell slightly clavate, reaching the top of the deep brown epithelial gel; asci clavate to ellipsoid, about $42 \times 14\ \mu$, tip about $4\ \mu$ thick, 8-spored; ascospores ellipsoid, $13 \times 6\text{--}7\ \mu$, with a moderately thick episporium.

The thecia of most of the apothecia was partly eaten away by insects some time before the specimens were collected. Where the algal layer under the parathecium was reached, regeneration produced a thin cortex and isidia similar to those of the exciple; where only the parathecium was exposed, it regenerated to form a narrow, biatorine margin by growing up the sides of the thecium. *Dümmer 602 p. p. min.* agrees with des Abbayes' description that the medulla is KC yellow becoming ferruginous as the solution dries. *Thomas 3029* are somewhat larger but sterile plants.

SIERRA LEONE: Kori, Njala, on branch of *Amphimas pterocarpoides*, F. C. Deighton M5093A, at Kew, sterile.

UGANDA: Seso, near Towa Forest, on rocks in grassland, 1215 m., A. S. Thomas 3029, at Kew, sterile; Kipango, 1290 m., on bark of *Albizia Brownei*, R. A. Dümmer 602 p. p. min., at Kew, fertile.

PARMELIA (HYPOTRACHYNA) *meizosporoides* Dodge, sp. nov.

Parmelia meizospora f. *isidiosa* Müll. Arg., Flora 67:620. 1884, nom nud.

Type: Madagascar, Imerina, Andrangolaoka, J. M. Hildebrandt, ex herb Sbarbaro at Farlow Herb.

Thallus 6 cm. diametro, roseo-cinnamomeus (1957), centro rugoso; lobis periphericis 25 mm. longitudine, infra 10 mm. latitudine, irregulariter dichotomis, sinibus parvis rotundatis, superne subpinnatis, lobulis ultimis rotundatis, crenatis, breviter ciliatis, 5 mm. longitudine, 10 mm. latitudine, laevibus, K flavescens; isidiosus isidiis tenuibus, simplicibus aut raro dichotomis; inferne niger, dense rhizinosus, marginibus papillatis verrucosisve; cortex superior $15\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, $3\ \mu$ diametro; stratum algarum coloniis *Trebouxiae*, $15\ \mu$ diametro, discretis sed densis; medulla K–, C–, KC–, $50\ \mu$ crassitudine, hyphis longitudinalibus compactis, granulis bruneis nubilatis; cortex inferior 12–15 μ crassitudine, niger, pseudoparenchymatice fastigiatus, cellulis 3–4 μ diametro.

Apothecia sessilia, 1–3 mm. diametro, marginibus integris dein crenatis in apotheciis maioribus; excipulo laevi, disco imperforato, aurantiaco-rufo; cortex amphithecialis $40\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, $5\text{--}7\ \mu$ diametro; stratum algarum coloniis discretis, $15\ \mu$ diametro; medulla compacta, granulis brunneis nubilata; stratum algarum sub parathecio continuum, $15\ \mu$ crassitudine; parathecium $10\ \mu$ crassitudine, fastigiatum, gelifactum; hypothecium $25\ \mu$ crassitudine, hyphis tenuibus periclinalibus; thecium $50\ \mu$ altitudine; paraphyses tenues, simplices, apicibus clavatis $4\text{--}5\ \mu$ diametro; asci clavati, $42 \times 10\ \mu$, leptodermei, apicibus incrassatis; ascospores octonae, ellipsoideae, $9\text{--}10 \times 5\text{--}6\ \mu$.

Thallus probably at least 6 cm. in diameter, pinkish cinnamon to light pinkish cinnamon (1957), central portion coarsely rugose, peripheral lobes 10 mm. wide below, 25 mm. long, irregularly dichotomous below with small rounded sinuses, subpinnate above, ultimate lobules rounded, crenate, very short ciliate, 5 mm. long, 10 mm. wide, surface smooth, K yellow, very isidiose in the center, less so on the marginal lobes, none on the ultimate lobules; isidia very slender, mostly simple, some dichotomous; underside black, very densely rhizino-se, papillate to verrucose at the margins; upper cortex $15\ \mu$ thick, of fastigate, thinwalled pseudoparenchyma, cells about $3\ \mu$ in diameter, rather irregularly arranged; algal layer of close but discrete colonies of *Trebouxia*, $15\ \mu$ in diameter, cells $5\text{--}6\ \mu$ in diameter; medulla K-, C-, KC-, $50\ \mu$ thick, of moderately closely woven longitudinal hyphae, except next the lower cortex, nubilated with minute brownish granules; lower cortex $12\text{--}15\ \mu$ thick, black, of fastigate pseudoparenchyma, cells $3\text{--}4\ \mu$ in diameter.

Apothecia sessile on central portion of the thallus, 1–3 mm. in diameter, margin entire becoming crenate in the larger apothecia, exciple smooth, disc imperforate, orange rufous to auburn; amphithecial cortex $40\ \mu$ thick, of fastigate, thinwalled pseudoparenchyma, cells $5\text{--}7\ \mu$ in diameter; algal layer of discrete colonies, $15\ \mu$ in diameter; medulla closely woven, heavily nubilated with brownish crystals; algal layer under the parathecium $15\ \mu$ thick, continuous; parathecium $10\ \mu$ thick, fastigate, highly gelified; hypothecium $25\ \mu$ thick, of closely woven, slender, periclinal hyphae; thecium $50\ \mu$ tall; paraphyses slender, unbranched, tips clavate, $4\text{--}5\ \mu$ in diameter, ending about $4\ \mu$ below the surface of the hyaline epithelial gel; asci clavate, $42 \times 10\ \mu$, 8-spored, wall thin, tip thickened; ascospores ellipsoidal, $9\text{--}10 \times 5\text{--}6\ \mu$.

MADAGASCAR: Imerina, Andrangolaoka, J. M. Hildebrandt, ex herb. Sbarbaro at Farlow Herb.

PARMELIA (HYPOTRACHYNA) LEPTOPHYLLA Müll. Arg., Flora 74:377. 1891.

Type: S. Africa, Baziya, Baer 714 at Kew.

Thallus 7–8 cm. in diameter, between deep olive buff and avellaneous, peripheral lobes 30 mm. long, 5 mm. wide below, dichotomous, ultimate lobules about 3 mm. long, 2 mm. wide, margins crenate, sinuses slightly rounded, revolute, with rare short cilia, central lobes smaller, lobulate, lobules variously shaped, surface smooth, opaque, minutely reticulate rimulose in older portions with abundant isidioid

soredia (a few just beginning to develop in our rather young plants); underside black, rhizinose, papillose toward the tips of the lobes, the outer mm. nude, Prouts brown or darker; upper cortex $20\ \mu$ thick, of fastigate pseudoparenchyma, cells $5\ \mu$ in diameter, relatively thinwalled, nubilated by nearly hyaline granules; algal layer $30\ \mu$ thick, of close, discrete colonies of *Trebouxia*, cells more densely packed above, $6\text{--}7\ \mu$ in diameter; medulla K-, C-, KC-, $160\ \mu$ thick, the upper $90\ \mu$ of close longitudinal hyphae, so heavily nubilated with hyaline granules as to nearly obscure the structure, the lower part only slightly nubilated; lower cortex $16\ \mu$ thick, pseudoparenchymatous from thickwalled longitudinal hyphae, about $8\ \mu$ in diameter; rhizinae $55\ \mu$ in diameter.

Apothecia 2–2.4 mm. in diameter, margin and exciple sorediose, disc concave, reddish fuscous, epruinose; ascospores $8 \times 5\ \mu$.

The description of the apothecia is translated from the original description as all our material is sterile.

UGANDA: Kigezi, Mafuga, 2250 m., growing over mosses on trees, I. R. Dale L18 p. p. min., fragmentary and identification uncertain.

SOUTH AFRICA: Ungoe Mts., W. Plants, two sterile fragments on right, at Kew; Kentani, growing over *Lobaria comorensis* (Krmph.) Zahlbr. and overgrown by *Anaptychia* sp., Alice Pegler, ex S. African Mus. at Kew.

PARMELIA (HYPOTRACHYNA) CONCRESCENS Vainio, Cat. Welwitsch African Pl. 2:400. 1901.

Parmelia capensis Nyl., Flora 68:613. 1885, non Ach.

Parmelia austroafricana Zahlbr., Cat. Lich. Univ. 6:152. 1929, non Stirton, 1877.

Parmelia caffrorum Zahlbr., Cat. Lich. Univ. 8:555. 1932.

Type: Angola, Huila, Serra da Chela, 1225–1775 m., truncicole, *Welwitsch* 30. Type of *P. capensis* Nyl. non Ach., *P. austroafricana* Zahlbr. non Stirton and *P. caffrorum* Zahlbr. is from South Africa, *Drège*.

Thallus light mineral gray, buffy olive in areas densely covered by isidia, K slowly yellow, 4–6 cm. in diameter, but concretescent into much larger patches; marginal lobes flat, imbricate, about $10 \times 3\text{--}5$ mm., irregularly dichotomous, sub-pinnate, with excised sinuses, ultimate lobules 0.5–1.0 mm. wide, tips truncate to slightly rounded and when very short with shallow sinuses appearing crenulate; isidia covering the whole center and the basal portions of the marginal lobes, slender, short, simple or rarely dichotomous near the tips, very crowded, completely obscuring the underlying thallus; underside black, rhizinae moderately close, sometimes torn away in collecting and represented by small pseudocypelloid areas; upper cortex $20\ \mu$ thick, of fastigate pseudoparenchyma, cells $3\text{--}4\ \mu$ in diameter; algal layer of discrete colonies of *Trebouxia*, about $25\ \mu$ in diameter, cells $6\text{--}7\ \mu$ in diameter, separated by vertical medullary hyphae, isidia formed by a tuft of vertical branches of medullary hyphae pushing a small algal colony up through the cortex; medulla K-, C-, KC slowly yellow, $130\text{--}145\ \mu$ thick, of predominantly longitudinal, very thickwalled hyphae, $3\text{--}4\ \mu$ in diameter, closely woven and nubilated with hyaline granules; lower cortex fastigate, $10\ \mu$ thick, a single layer of thickwalled dark brown cells, $10 \times 5\ \mu$.

Apothecia 5 mm. in diameter, urceolate, margin entire at first, becoming in-rolled, granular isidioid, exciple smooth at first then longitudinally sulcate and

finally reticulate rugose and subscrobiculate; disc chestnut, concave; amphithecial cortex $30\ \mu$ thick, fastigiate, hyphae $3\ \mu$ in diameter, outer $10\ \mu$ brownish and somewhat nubilated; algal layer $30\ \mu$ thick, continuous, with occasional colonies pushing up through the cortex to form isidia, cells $6-7\ \mu$ in diameter; medulla closely wove, heavily nubilated with brownish granules; algal layer under the parathecium $20\ \mu$ thick, continuous; parathecium $30\ \mu$ thick, of fastigiate pseudo-parenchyma, protoplasts $2\ \mu$ in diameter; hypothecium $15-20\ \mu$ thick, of slender, very closely woven, predominantly periclinal hyphae; thecium $80\ \mu$ tall; paraphyses slender, dichotomous above the asci, tips not thickened, reaching nearly the surface of the brownish epithelial gel; asci clavate, $65 \times 13\ \mu$, wall thick and tips very thick when young, protoplast acuminate, wall thin at maturity; ascospores ellipsoid, $9-10 (-12) \times 6-7\ \mu$, with a thick epispore.

P. capensis Nyl. non Ach was based on plants with mature apothecia while *P. conrescens* Vainio was based on plants with immature apothecia. The chemical reactions agree so far as given. *Curtis 700b* has apothecia in all stages of development, the younger agreeing with those described by Vainio and the mature ones with those described by Nylander.

CONGO: Kahusi, ca. 2700 m., *F. L. Hendricks 4316* p. p. min. in E. African Herb.

KENYA: buffalo country south of Narossaro, growing over orchid roots on bark, 1610-2250 m., *Anita Grosvenor Curtis 700b* in Dodge Herb.; Eldoret near Lamok River, 2220 m., on uliowa tree, *G. R. Williams 90a*, fragment, at Kew.

UGANDA: Kigezi, Mafuga, 2415 m., on rocks, *I. R. Dale L46*, sterile; Maiguru Ridge, 2250-2580 m., corticole, *I. R. Dale L48* p. p. min.; Bugishu, Bulambuli, 935 m., in bamboo forest, *A. S. Thomas 549* p. p. min.; all at Kew.

TANGANYIKA: Usambara, Muandara, *C. Holst 2649* p. p. det. *P. laevigata* v. *isidiosa* Müll. Arg. by Müller Argau at Kew (juvenile).

PARMELIA (HYPOTRACHYNA) *Gillettii* Dodge, sp. nov.

Type: Somaliland, Libah Mele Mt., 1675 m., above Buja Soldan, $10^{\circ} 20' N.$, $43^{\circ} E.$, on twigs of *Grewia* sp.?, *J. B. Gillett 4699* p. p., Abyssinia-Somaliland Boundary Commission, at Kew.

Thallus 6 cm. longitudine, 2.5 cm. latitudine, ramulos involvens, pallide olivaceo-alutaceus, lobis periphericis eciliatis, 7 mm. longitudine, 1.5-2 mm. latitudine, irregulariter dichotomis, sinibus excisis, apicibus truncatis, superficie centro rugosa, ad margines laevior, dense isidiosus, isidia granulosa aut tenuia, submoniliformia, non ramosa; inferne obscure fuscus, ad margines pallidior, rhizinis densis; cortex superior $10\ \mu$ crassitudine, fastigiatus, cellulis $3\ \mu$ diametro, granulis brunneis sparsim nubilatus; stratum algarum subcontinuum, coloniis *Trebouxiae* $15\ \mu$ diametro, discretis, cellulis ad $8\ \mu$ diametro; medulla K flavens dein auranticorubens, C-, KC-, $40\ \mu$ crassitudine, arachnoidea, hyphis pachydermeis, $3\ \mu$ diametro; cortex inferior $15\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis pachydermeis, $5\ \mu$ diametro.

Apothecia 2.5 mm. diametro, cupuliformia, margine inflexo, integro, excipulo primum laevi, dein isidiosissimo, disco brunneo, concavo; cortex amphithecialis $30\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, protoplastis $3\ \mu$ diametro; coloniis algarum sparsis ca. $20\ \mu$ diametro; medulla laxa contexta (densius quam in thallo); stratum algarum sub parathecio $20\ \mu$ crassitudine, continuum; parathecium $20\ \mu$

crassitudine, pseudoparenchymatice fastigiatum sed cellulis subirregulariter dispositis; hypothecium $15\ \mu$ crassitudine, hyphis tenuibus, periclinalibus dense contextis; thecium $55\ \mu$ altitudine; paraphyses tenues, sparsim septatae, semel super ascos dichotomae, apicibus non incrassatis; asci clavati, $40 \times 8\ \mu$, apicibus juvenile incrassatis; ascosporae octonae, ellipsoideae, $13.5 \times 8\ \mu$, episporio crasso.

Thallus about 6 cm. long, 2.5 cm. wide, wrapped around small branches, pale olive buff, peripheral lobes eciliate, 7 mm. long, 1.5–2 mm. wide, irregularly dichotomous, sinuses excised, tips sinuate or truncate; surface rugose in the center, smoother toward the margins, densely isidiose, isidia varying from granulose to very slender, moniliform, simple; underside dark fuscous, paler at the margin, completely covered with dense rhizinae; upper cortex $10\ \mu$ thick, fastigate, cells $3\ \mu$ in diameter, walls moderately thick, brownish, slightly nubilated with brownish granules; algal layer $15\ \mu$ thick, of discrete colonies of *Trebouxia*, cells $8\ \mu$ in diameter, in a nearly continuous layer; medulla K yellow then orange red, C–, KC–, about $40\ \mu$ thick, arachnoid with nearly as many vertical as longitudinal hyphae, thickwalled, $3\ \mu$ in diameter; lower cortex $15\ \mu$ thick, of fastigate pseudoparenchyma, cells thickwalled, about $5\ \mu$ in diameter.

Apothecia 2.5 mm. in diameter, cupiliform, margin inflexed, entire, exciple smooth at first becoming densely isidiose; disc Brussels brown, remaining concave; amphithecial cortex $30\ \mu$ thick, of fastigate pseudoparenchyma, protoplasts $3\ \mu$ in diameter; algal layer of very scattered colonies, $20\ \mu$ in diameter; medulla loosely woven but denser than the thalline medulla; algal layer under the parathecium about $40\ \mu$ thick, continuous; parathecium $20\ \mu$ thick, of fastigate pseudoparenchyma, cells quite irregularly arranged; hypothecium $15\ \mu$ thick, of slender, closely woven, periclinal hyphae; thecium $55\ \mu$ tall; paraphyses slender, sparingly septate, about once dichotomous above the asci, tips not thickened; reaching the top of the nearly hyaline epithecial gel; asci 8-spored, clavate, $40 \times 8\ \mu$, tip thickened when young; ascospores $13.5 \times 8\ \mu$, ellipsoid, with a moderately thick episporio.

SOMALILAND: Libah Mele Mt., 1675 m., above Buja Soldan, $10^{\circ} 20' N.$, $43^{\circ} E.$, on twigs of *Grewia* sp.?, J. B. Gillett 4699 p. p. type, Abyssinia-Somaliland Boundary Commission, at Kew.

PARMELIA (HYPOTRACHYNA) *subisidiosa* (Müll. Arg.) Dodge, comb. nov.

Parmelia cetrata v. *subisidiosa* Müll. Arg., Bot. Jahrb. [Engler] 20:256. 1894.

?*Parmelia tiliacea* v. *eximia* Stein, Jahresber. Schles. Ges. Vaterl. Kultur 66:138. 1888.

Type: Tanganyika, Usambara, Bumba, Holst 8772 p. p. The type of *P. tiliacea* v. *eximia* Stein is from South Usambara, Hans Meyer, not seen.

Thallus 7 cm. or more in diameter, between olive buff and vinaceous buff, marginal lobes about 10 mm. long, 5 mm. wide, sometimes dichotomous near the ends, margins crenate to lacerate and isidiose, ciliate, cilia slender, up to 0.6 mm. long, distant; surface smooth, central portion isidiose, isidia up to 1 mm. long, very fragile, leaving scars through which medullary hyphae protrude, giving the appearance of pseudocypbellae or minute soredia, some isidia aborted and the tip growing out as a cilium resembling the marginal cilia but smaller; underside black shading to chestnut at the margin, rhizinae covering the whole underside, or a few lobes nude in the outer mm., short, dense; upper cortex $15\ \mu$ thick, of fastigate

pseudoparenchyma, cells relatively thinwalled, 7–8 μ in diameter; algal layer 15 μ thick, continuous, both layers heavily nubilated with brownish granules; medulla K–, C–, KC–, 30–40 μ thick, of predominantly longitudinal hyphae, very loosely woven, especially so below, irregularly nubilated with grayish granules; lower cortex black, pseudoparenchymatous from longitudinal hyphae; rhizinae 65 μ in diameter, formed by outgrowth of the hyphae of the lower cortex.

MOZAMBIQUE: Makua Country, Mt. Namuli, growing over bryophytes and epiphytic roots, J. T. Last, at Kew.

PARMELIA (HYPOTRACHYNA) ISIDIZA Nyl., Bol. Soc. Broter. 3:130. 1884.

Type: Angola, Moçâmedes, Serra da Chela, Caionda, on mopane tree, *Frank Newton*.

Thallus at least 6 \times 3 cm., chamois, peripheral lobes 10 mm. long, 5 mm. wide at the base, irregularly dichotomous, ultimate lobules subtruncate to rounded, margins minutely isidiose and ciliate, cilia about 1 mm. long, about 1 mm. apart, surface smooth to rugulose, isidiose, isidia quite dense in the center, rare on marginal lobes, short, simple, rarely forked; underside black, rhizinae moderately dense in the center, becoming papillae toward the margin with a nude zone 1 mm. wide; upper cortex 30 μ thick, of fastigiate pseudoparenchyma, cells about 5 μ in diameter, heavily nubilated with brownish granules in the outer half; algal layer of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla K–, C pink soon fading, KC–, 80 μ thick, of closely woven, longitudinal hyphae 3 μ in diameter, nubilated with brownish granules, more densely so above; lower cortex black, 13–15 μ thick, pseudoparenchymatous, cells about 5 μ in diameter with thick black walls, irregularly arranged.

Apothecia 2–4 mm. in diameter, margin subcrenate, disc fusco-rufescent; ascospores ellipsoid, 9–12 \times 6–8 μ , fide Nylander.

Nylander gives the medulla as K yellow becoming ferruginous, while our material is K– when only the medulla is moistened. If a drop of K from the upper surface spills over to the medulla, it is dyed yellow, as the reagent dissolves some of the dye from the cortex. It becomes ferruginous as the solution dries. Nylander does not mention cilia. Our material is sterile and the description of the apothecia is translated from the original description.

ANGOLA: Cabinda, Maiombe, Chiloango, J. Gossweiler 8033 p. p., at Kew.

NORTHERN RHODESIA: Abercorn, growing over *Cryptorchis* roots on *Brachystegia taxifolia*, in dense shade of crown, A. A. Bullock 2104 p. p. min., International Red Locust Control Service, at Kew.

PARMELIA (HYPOTRACHYNA) sublaevigatoides Dodge, sp. nov.

Type: Uganda, Mt. Elgon, 1290 m., substrate and collector unknown, Dec. 1914, at Kew.

Thallus ad 6 cm. diametro, ochraceo-alutaceus centro, marginibus pallidioribus, lobis 5 \times 2–3 mm., pinnatim lobulatis, raro irregulariter dichotomis, lobulis ca. 1 mm. latitudine minus quam 1 mm. longitudine, apicibus rotundatis, sinibus subexcisis, superficie opaca, laevi, sparsim minuteque isidiosus, marginibus sparsim ciliatis, ciliis conicis, 0.25 mm. longitudine; infra niger, marginibus brunneis,

nitidis; rhizinae centro 0.75 mm. longitudine, ad margines breviores; cortex superior 13 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 20 μ crassitudine, coloniis cellulisque sparsis, 3–4 μ diametro; medulla K–, C–, KC–, 30–35 μ crassitudine, hyphis longitudinalibus, 5–6 μ diametro, contextis; cortex inferior 10 μ crassitudine, hyphis longitudinalibus 3–5 μ diametro, cellulis isodiametricis; rhizinae 35 μ diametro.

Thallus 6 cm. in diameter, ochraceous buff in the center, shading to light ochraceous buff at the margins, K–, C bleached to white, lobes 5 \times 2–3 mm., pinnately lobulate, irregularly subdichotomous, lobules about 1 mm. wide, less than 1 mm. long, tips rounded, sinuses subexcised, surface dull, smooth, sparsely and minutely isidioid even on the marginal lobes; margins sparsely ciliate, cilia conic, 0.25 mm. long; underside black in the center shading to antique brown at the margins, shining; rhizinae 0.75 mm. long in the center, progressively shorter toward the margins, black; upper cortex 13 μ thick, of fastigate pseudoparenchyma, cells very thickwalled, conglutinate, outer two thirds yellowish brown; algal layer 20 μ thick, of small scattered colonies and single cells of *Trebouxia*, 3–4 μ in diameter; medulla K–, C–, KC–, 30–35 μ thick, of predominantly longitudinal hyphae 5–6 μ in diameter, very closely interwoven, heavily nubilated with grayish granules; lower cortex 10 μ thick, black, of 2–3 layers of isodiametric cells, apparently from longitudinal hyphae, growing out to form rhizinae up to 35 μ in diameter. Apothecia and spermogonia not seen.

The thallus from Portuguese East Africa is somewhat larger, about 6 cm. long, 1.8 cm. wide, completely surrounding a coffee branch about 6 mm. in diameter.

CONGO: Mt. Kahusi, 2700 m., on twig, *F. L. Hendrickx 4314* p. p. min. in E. African Herb.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, *A. S. Thomas 549* p. p.; Buginyanya, on rocks, 2100 m., *A. S. Thomas 465*, Mt. Elgon, 1290 m., substrate and collector unknown, Dec. 1914, type, all at Kew.

TANGANYIKA: Ufipa, Chapota, 2100 m., growing over *Polystachya* roots on *Brachystegia*, *A. A. Bullock 2035* p. p. min. International Red Locust Control Service at Kew.

NYASALAND: Luchunya Plateau, Mlanje District, Mt. Mlanje, 2100 m., growing over and with *Parmelia usambarensis*, *L. J. Brass 16474a*, Vernay Nyasaland Exp. in Dodge Herb., juvenile.

PORTUGUESE EAST AFRICA: Inhambane District, Inhamine, *D. Luiz Sousa* p. p. min. Oct. 1937, at Kew.

PARMELIA (HYPOTRACHYNA) foliolosa Dodge, sp. nov.

Type: Madagascar, East Imerina, Andrangolaoka, terricole, *J. M. Hildebrandt*, Nov. 1880, com. *C. Rensch* sub *P. perforata* (L.) Nyl. v. *ulophylla* Mey. & Fw. ex herb. Hasse and ex herb. Sbarbaro at Farlow Herb.

Thallus ad 6 cm. diametro, obscure olivaceo-alutaceus, anguste brunneo-marginatus, ciliatus, ciliis ad 0.5 mm. longitudine, lobis irregulariter dichotomis, inferne 5 mm., superne 10 mm. latitudine, marginibus lobulatis, lobulis aliis 0.5 mm. latitudine, cum soraliis subsphaericis terminalibus 0.6 mm. diametro, alteris 1 \times 1 mm., apicibus truncatis retusisve, aliis suborbicularibus, 1 mm. diametro, lobis periphericis rotundatis, crenatis, lobulis 1–2 mm. latitudine, basi non constrictis, esorediosis; superficie albo-reticulata, rimuloso-areolata verrucosave; soredia granulosa; inferne opacus, centro niger, marginibus rufo-brunneis subnudis; rhizinae

confertae, breves; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 4 μ diametro; stratum algarum 20 μ crassitudine, coloniis *Trebouxiae*, subcontinuum, cellulis 5 μ diametro; medulla K-, C-, KC-, 80 μ crassitudine, hyphis pachydermeis, longitudinalibus, 3 μ diametro, granulis griseis nubilatis, superne dense contextis, inferne laxioribus; cortex inferior niger, 10 μ crassitudine, hyphis pachydermeis, longitudinalibus, cellulis isodiametricis; cilia rhizinaeque 35 μ diametro.

Thallus up to 6 cm. in diameter, deep olive buff, very narrowly dark brown margined with abundant cilia up to 0.5 mm. long, mostly shorter, lobes irregularly dichotomous, about 5 mm. wide below, expanding to 10 mm. wide above, margins lobulate below, some lobules about 0.5 mm. wide at the base, bearing terminal, subspherical soralia 0.6 mm. in diameter, others about 1 mm. wide and long, tips truncate or retuse, others nearly circular, 1 mm. in diameter with a very narrow base; marginal lobes rounded, deeply crenate with lobules 1-2 mm. wide, not constricted at the base, tips semicircular, not bearing soredia; upper surface white reticulate, smooth in outer portion, becoming very coarsely verrucose in the older portions, rimulose areolate, some groups of verrucae forming soredia in irregular areas, 4 mm. or more wide, soredia coarsely granular; underside opaque, black in the central portions, margins auburn, shining, nude in the outer 1 mm.; rhizinae short, close, becoming papillae on the marginal lobules, broken away in the central portion when removing the soil, apparently breaking near the surface of the thallus but not pulling away the surrounding lower cortex as usually happens; upper cortex 15 μ thick of fastigate pseudoparenchyma, cells 4 μ in diameter, the outer 7-10 μ greenish brown, the rest hyaline; algal layer 20 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells about 5 μ in diameter; medulla K-, C-, KC-, 80 μ thick, of longitudinal, very thickwalled hyphae 3 μ in diameter, so heavily nubilated with grayish granules that the structure is not clear in thick sections, very closely interwoven in the upper 65 μ , looser and less nubilated in the lower 15 μ , tending to tear in sectioning; lower cortex black, 10 μ thick, of thickwalled, longitudinal hyphae with nearly isodiametric cells, extending up over the margin of the upper surface for 100 μ ; cilia and rhizinae 35 μ in diameter, both outgrowths of the lower cortex.

MADAGASCAR: East Imerina, Andrangolaoka, terricole, J. M. Hildebrandt Nov. 1880, com. C. Rensch sub *Parmelia perforata* (L.) Nyl. v. *ulophylla* Mey. & Fw. ex herb. Hasse and ex herb. Sbarbaro at Farlow Herb.

PARMELIA (HYPOTRACHYNA) SUBAEQUANS Nyl. in Crombie, Jour. Bot. Brit. For. 14:19. Jan. 1876; Jour. Linn. Soc. Bot. 15:167. 1876.

Type: Cape of Good Hope, A. E. Eaton, Venus Transit Exp.

Thallus at least 5 cm. in diameter, probably larger, Natal brown to wood brown (1957), central lobes 4-5 mm. wide, irregularly dichotomous to subpinnate toward the ends, narrower at each dichotomy, ultimate lobes about 1 mm. wide and long, tips truncate to retuse, sinuses rounded, margins not truly ciliate, but long rhizinae bending outward and showing for a distance of 1 mm. beyond the margin, surface pseudocyphellate, punctiform to more often lirellate; underside black, rhizinae slender, branched, up to 1.5 mm. long, covering the whole under-

side; upper cortex 15 μ thick, of fastigate pseudoparenchyma, cells 3–4 μ in diameter, very thickwalled and heavily nubilated with greenish brown granules; algal layer about 20 μ thick, of scattered cells and small colonies of *Trebouxia* in a continuous layer; medulla K–, C–, KC– or faint ochroleucous, about 100 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with grayish granules, the lower 30 μ very loosely woven with large air spaces; lower cortex black, 23 μ thick, pseudoparenchymatous from longitudinal hyphae about 5 μ in diameter; rhizinae 30 μ in diameter.

Apothecia 2–3 mm. in diameter, urceolate, margin entire, inrolled, longitudinally sulcate striate when young, nearly smooth when mature; exciple smooth, becoming pseudocypheolate, not sorediose above, disc auburn or darker, remaining concave; amphithecial cortex 80 μ thick, of fastigate pseudoparenchyma, hyaline, the outer gel faintly brownish; algal layer 30–40 μ thick, of discrete colonies, located about 25 μ inside the cortex, tending to die out below, leaving large lacunae in the medulla; medulla very loosely woven, tending to tear apart in sectioning; algal layer under the parathecium, 40 μ thick, of close but discrete colonies; parathecium 40 μ thick, of somewhat irregular fastigate pseudoparenchyma; hypothecium 30 μ thick, of slender periclinal hyphae, very closely woven below and above, looser in the middle; thecium 50 μ tall; paraphyses slender, septate, dichotomous in the upper half, tips slightly clavate, ending in the brownish epithecial gel; asci clavate, $40 \times 15 \mu$, wall 3 μ thick, tip 7 μ , protoplast mamillate when young; ascospores ellipsoid, episore 2 μ thick, $16\text{--}20 \times 8\text{--}10 \mu$ ($12\text{--}16 \times 4\text{--}6 \mu$ measured without the episore).

Nylander describes the ascospores as $14\text{--}15 \times 9\text{--}11 \mu$; in our specimen the ascospores are narrower, but it agrees with the original description in all other respects.

SOUTH AFRICA: *Drège*, ex herb. Sonder sub *P. saxatilis* Ach. in Tuckerman Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) INSIGNATA Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9:162. 1890.

Type: Cape of Good Hope, Mt. Leon near Capetown, *P. MacOwan*.

Thallus probably more than 5 cm. in diameter, ashy to olive-green, becoming buffy citrine in the center to ochraceous buff at the margins (after more than 40 years in the herbarium); peripheral lobes rounded, crenate to lobulate, surface subscrobiculate with the radial ridges more prominent than the transverse, nearly smooth at the margins, powdery sorediate on some lobules (perhaps in older specimens more continuously sorediate and pseudocypheolate along the ridges), soralia round, up to 0.8 mm. in diameter, soredia coarsely granular to isidioid; underside not seen as it is closely attached to rough bark, margins dark toward center of marginal lobes, abruptly warm buff or paler toward the margin, with pale rhizinae all the way to the margin; upper cortex 25 μ thick, of gelified, fastigate pseudoparenchyma, protoplasts spherical, 2 μ in diameter, somewhat irregularly arranged; algal layer 25 μ thick, of colonies of *Trebouxia* and single cells in a nearly continuous layer, cells 10 μ in diameter; heavily nubilated with grayish granules;

medulla K-, C-, KC pink, 100 μ thick, the upper 30 μ of very loosely woven vertical and oblique hyphae with large air spaces and tearing apart here on sectioning, the rest of closely woven, predominantly longitudinal hyphae 3 μ in diameter; lower cortex 15 μ thick, similar to the upper cortex.

Apothecia sessile, 5–6 mm. in diameter, urceolate with inrolled margins at first, then nearly flat, margin minutely crenulate, cracked nearly to the center of the disc in the flatter apothecia; exciple shallowly rugose; disc imperforate, chestnut; amphithecial cortex 65 μ thick, of gelified, fastigate pseudoparenchyma, lumina 1 μ in diameter above, about 2 μ in diameter, 4 μ long below; algal layer of small colonies at the margin, disappearing below; medulla loosely woven; algal layer under the parathecium 30–50 μ thick, nearly continuous; parathecium 20 μ thick, gelified, lumina about 2 μ in diameter, rather irregularly arranged; hypothecium 10–13 μ thick, of slender, closely woven, periclinal hyphae; thecium 45 μ tall; paraphyses several times dichotomous in the upper half, branches moniliform, tips not thickened, ending about 3 μ below the surface of the orange epithelial gel; asci broadly clavate, 40 \times 20 μ , wall 3 μ thick, tip 7 μ , 8-spored; ascospores broad ellipsoidal, 10–13 \times 7–9 μ , with a thick episore.

SOUTH AFRICA: Cape Province, Paarl District, on *Quercus*, P. A. van der Bijl 80 sub *P. dubia*, in G. K. Merrill Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) BIJLII Vainio, Ann. Univ. Fenn. Aboens. A 2:3:1. 1926.

Type: S. Africa, Cape Province, Klapmuts, on *Quercus*, P. A. van der Bijl 128.

Thallus about 4 cm. in diameter, deep olive buff, shading toward vinaceous buff on some lobes, peripheral lobes irregularly dichotomous with short internodes, appearing subpinnate, sinuses rounded to subexcised, ultimate lobules 1.5–2 mm. long, 1–1.5 mm. wide, terminal lobules a little larger, lower lateral lobules capitate sorediate, upper surface often soraliate, soralia 0.2–0.5 mm. in diameter, soredia granular, very rarely confluent; underside black, rhizinoe to the margin, not truly ciliate but sometimes appearing so by the rhizinae bending outward beyond the margin; upper cortex 30 μ thick, of fastigate pseudoparenchyma, cells 8 μ in diameter, thinwalled, heavily nubilated with pale brownish granules in the outer half; algal layer 30 μ thick, cells 7–8 μ in diameter in a nearly continuous layer, heavily nubilated with pale granules; medulla K-, C rose red fading, KC-, 105–120 μ thick, of predominantly longitudinal hyphae, the upper 20 μ almost arachnoid, the rest very closely woven and very heavily nubilated with grayish granules; lower cortex black, 15 μ thick, of fastigate pseudoparenchyma, cells relatively thinwalled, 7–8 μ in diameter; rhizinae 55 μ in diameter, formed by the outgrowth of cortical cells.

SOUTH AFRICA: Kentani District, Alice Pegler, fragment ex S. African Mus.

TANGANYIKA: Usambara, Muandara Wald, growing with hepatics and a species of the *Anaptychia leucomelaena* group C. Holst 2649 p. p. min. (upper left plants), at Kew.

PARMELIA (HYPOTRACHYNA) TENUIRIMA Hook. f. & Taylor, f. SOREDIATA Müll. Arg., Bot. Jahrb. [Engl.] 20:259. 1894.

Type: Tanganyika, Usambara, Holst 787, p. p.

Thallus 5–6 cm. in diameter, deep olive buff to olive buff, peripheral lobes rounded, about 6 mm. wide and long, margins crenate, sinuses rounded to excised on the sides, eciliate, but an occasional submarginal rhizina bends outward and simulates a cilium, upper surface smooth, with minute cracks near the ends of the lobes, giving rise to lines of minute, granular soredia, more frequent and confluent toward the center of the thallus, forming patches 5–10 mm. in diameter, of minutely granular soredia; underside black becoming Dresden brown in a narrow zone at the margin, densely black rhizinose; upper cortex 8–10 μ thick, of fastigate pseudoparenchyma, cells small, very heavily nubilated; algal layer about 15 μ thick, of closely packed colonies of *Trebouxia*, cells 6–7 μ in diameter; medulla K. very pale yellow, C–, KC orange red, 45–50 μ thick, of densely woven, slender, longitudinal hyphae, heavily nubilated with brownish granules; lower cortex 15 μ thick, very dark brown, of fastigate pseudoparenchyma about 2 cells thick, growing out to form rhizinae 55 μ in diameter. Apothecia not seen.

This form probably represents a new species, as it differs from *P. tenuirima* Hook f. & Taylor in color, habit and most microscopic characters. I hesitate to give it a name until I have seen more abundant material.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, A. S. Thomas 549 p. p. min., at Kew.

PARMELIA (HYPOTRACHYNA) MANGENOTI des Abb., Bull. Inst. Franç. Afrique Noire 13:969. 1951.

Type: Côte d'Ivoire, Mankono (Cercle de Seguéla) on granite, 400 m., *H. des Abbayes*; Béoumi (Cercle de Bouaké) on trunk of mango, *H. des Abbayes*.

Thallus 10 (–15) cm. in diameter, pale ashy (yellowish glaucous in our specimen about a century old), K yellow above, KC yellow then orange red, peripheral lobes 15 mm. long, 3–5 (–7) mm. wide, crowded and more or less imbricate, subpinnate, sinuses rounded to excised, ultimate lobules 1–2.5 mm. long, 0.5–1 mm. broad, tips rounded to truncate, eciliate, capitate sorediate, soralia about 0.5 mm. in diameter, sometimes spreading from the margin to the upper surface of the lobe, in the center of the upper surface soon confluent into farinose crusts (only slightly farinose patches in our specimen as if the cortex had disintegrated in irregular areas, rather than from confluent soralia); underside black, rhizinose, margins chestnut to Sanford brown, nearly nude but with minute papillae; upper cortex 15 μ thick, of fastigate pseudoparenchyma, cells about 3 μ in diameter, slightly nubilated with grayish granules; algal layer 15–25 μ thick, of close discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C red, KC deep orange red, fading, the colors deeper just under the algal layer, 135 μ thick, of predominantly longitudinal hyphae, 3 μ in diameter, loosely woven under the algal layer, more closely so next the lower cortex, somewhat nubilated with minute grayish granules above, less so below; lower cortex dark brown, 15 μ thick, of fastigate pseudoparenchyma, cells 6–8 μ in diameter.

FERNANDO PO: Pico de Santa Isabel, 2740 m., on trees, *Gustavo Mann* 684, at Kew.

PARMELIA (HYPOTRACHYNA) USAMBARENSIS Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:524. 1926.

Type: Tanganyika, East Usambara, Lutindi, 700–800 m., corticole, *Brunnthalier*.

Thallus more than 10 cm. in diameter, cartridge buff, loosely attached to the bark, ultimate lobes more or less ascending; lobes 10 mm. wide, unequally dichotomous, divaricate, sinuses rounded, some of the central ultimate lobules up to 10×1.5 mm., peripheral ultimate lobules $1-2 \times 1$ mm., with very short internodes, appearing almost digitate; margins ciliate, cilia up to 2 mm. long, tips acute, mostly simple, rarely with a few short lateral branches, close to rare on different lobes; tips of the central lobes often capitate sorediose, often spreading down the margins; surface minutely white reticulate due to absence of brownish granules in the outer portion of the upper cortex, and in older portions cracking along the reticulations; underside black and nude in the center, shading to Dresden brown on the tips of the ultimate lobules, peripheral lobes rhizinose, rhizinae $40-70 \mu$ in diameter, dense, much branched, short, formed of fascicles of medullary hyphae, corticate from cells of the lower cortex; upper cortex $13-16 \mu$ thick, of fastigate pseudoparenchyma, cells thinwalled, $5-6 \mu$ in diameter, the outer 10μ heavily nubilated with brownish granules; algal layer 20μ thick, of discrete colonies of *Trebouxia*, about 20μ in diameter, in a nearly continuous layer, cells $5-6 \mu$ in diameter; medulla K-, C-, KC-, about 100μ thick, of closely woven, longitudinal hyphae, $3-4 \mu$ in diameter, with moderately thick walls, nearly all heavily nubilated with hyaline granules which obscure structure; lower cortex black, 7μ thick, of a single layer of closely septate, longitudinal hyphae.

Apothecia few, urceolate, imperforate at first, becoming perforate, $5-6$ mm. in diameter, constricted at the base but not stipitate, exciple smooth, finally somewhat rugose, margin crenate and lobulate incised, here and there sorediose; disc auburn; amphithecial cortex $30-38 \mu$ thick above, expanding to $50-55 \mu$ thick below, structure similar to the thalline cortex but cells larger, $7-10 \mu$ in diameter; algal layer under the parathecium $27-38 \mu$ thick, of discrete colonies; parathecium yellow ochraceous (combined parthecium and hypothecium $48-60 \mu$ thick); thecium $50-70 \mu$ tall; paraphyses filiform, 2μ in diameter, tips clavate $3-4 \mu$ in diameter in the brownish epithelial gel 7μ thick; asci broadly clavate, $28-40 \times 19-22 \mu$, thickwalled, 8-spored; ascospores broadly ellipsoid, $9-15 \times 6-8.5 \mu$, epispore scarcely 1μ thick.

Spermogonia $130-150 \mu$ in diameter, wall thickened and blackened about the ostiole; spermatiphores little branched, up to 67μ long, scarcely 2μ in diameter; spermatia bacilliform, straight, $7-11 \times 0.5-0.6 \mu$.

The description of the apothecia and spermogonia are translated and condensed from the original description as the apothecia in our single fertile specimen (*Dale* L48 p. p. min.) are very young. The youngest stage seen is spherical, about 65μ in diameter, consisting of an outer algal layer about 10μ thick, continuous with the thalline algal layer, the ascogonium, a coil 40μ long, 13μ in diameter, very deeply staining, closely septate into nearly isodiametric cells, prolonged upward into the thalline cortex as a very slender trichogyne, sparingly septate and scarcely staining. In a slightly older stage, young paraphyses have grown upward nearly to the thalline cortex. Both stages are still completely immersed below the thalline cortex.

Our specimens agree well with the original description except for the K reaction of the medulla. Our specimens have the thallus and medulla K-, while the original description calls for the medulla K yellow, here and there rufescent. Most of our specimens were growing at higher altitudes.

KENYA: Kinango, 2250 m., growing over bryophytes on forest trees, *Allen Turner* 6388, ex *Coryndon* Mus. at Kew.

UGANDA: Karamoja, Timu forest, 2100 m., truncicole, *A. S. Thomas* 3224; Kigezi, Mafuga, 2415 m., saxicole, *I. R. Dale* L46 p. p. min.; Naiguru ridge, 2250-2580 m., corticole, *I. R. Dale* L48 p. p. min.; 2415 m., growing over hepatics on bark, *I. R. Dale* L49 p. p. min.; all at Kew.

NYASSALAND: Mlanje District, Luchenya Plateau, Mt. Mlanje 2100 m., on exposed tree trunk, *L. J. Brass* 16474, Vernay Nyasaland Exp. in Dodge Herb.

NORTHERN RHODESIA: Abercorn, growing over *Cryptorchis* roots on *Brachystegia taxifolia*, in dense shade of crown, *A. A. Bullock* 2104 p. p. min., International Red Locust Control Service, at Kew.

ANGOLA: Amboim, Cuanza Sul. 1000 m., on dead tree, *J. Gossweiler* 9991 p. p. min. very immature, at Kew.

PARMELIA (HYPOTRACHYNA) decorata (Hue) Dodge, comb. nov.

Parmelia mutata f. *decorata* Hue, *Nouv. Ach. Mus. [Paris] IV. 1:172. 1899.*

Type: Reunion, *Rodrigues*; Madagascar, Betsileo, *Besson*, com. *Renauld*.

Thallus 14 cm. in diameter, ashy glaucescent becoming olive buff on peripheral lobes and pinkish buff on central portions, irregularly dichotomous, peripheral lobes 20 mm. long, 10 mm. wide, subimbricate, subpinnately lobulate with rounded sinuses, lobules 2-3 mm. wide and long, tips truncate to rounded, sparingly ciliate, cilia 0.5 mm. long (rhizinae bend outward and show at the margin, thus appearing closely ciliate at low magnifications); central lobes with smaller lobules, capitate sorediate, soralia subspherical, 1 mm. in diameter, very rarely confluent; surface minutely white reticulate, K yellow; underside black with shining chestnut margins, rhizinae short, close, becoming papillae at the margins; upper cortex 16-18 μ thick, of fastigiate pseudoparenchyma, cells thickwalled, rounded, 5-6 μ in diameter, the outer 10 μ nubilated with brownish granules and appearing greenish brown in thick sections, interrupted by cracks 10 μ wide through the algal layer, covered by an amorphous layer 2-3 μ thick; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5-6 μ in diameter, the lower half heavily nubilated with brownish granules; medulla K yellow reddening, C-, KC yellow then very slowly reddening, 55 μ thick, of closely woven, longitudinal, thickwalled hyphae 2-3 μ in diameter, very heavily nubilated with grayish brown granules; lower cortex 15 μ thick, black, pseudoparenchymatous from longitudinal thickwalled hyphae; rhizinae 35 μ in diameter formed by outgrowth of the hyphae of the lower cortex.

Apothecia short stipitate, 4-7 mm. in diameter, margin entire to very minutely crenulate, inrolled, exciple smooth, finally slightly sorediose, disc concave, orange rufous to Sanford brown; amphithecial cortex 65 μ thick below, thinning to 30 μ thick at the margin, fastigiate, very highly gelified; algal layer 15 μ thick, with some colonies pushing up into the cortex for 30 μ above the lower surface of the cortex; algal layer under the parathecium 20 μ thick, continuous, cells somewhat less crowded than in the thalline layer; parathecium 20-25 μ thick, fastigiate, of

very thickwalled gelified hyphae; hypothecium $60\ \mu$ thick, of very thickwalled and gelified, periclinal hyphae, a little thinner-walled and less gelified in the upper $10\text{--}15\ \mu$; thecium $75\text{--}80\ \mu$ tall; paraphyses $1.5\text{--}2\ \mu$ in diameter, septate, tips not or very slightly thickened, ending $9\text{--}12\ \mu$ below the surface of the hyaline epithelial gel; asci $65 \times 15\ \mu$, wall $3\ \mu$ thick, tip slightly thicker, protoplast mamillate, 8-spored; ascospores $14\text{--}17 \times 7\text{--}9\text{--}(12)\ \mu$, with a moderately thick epispore.

Spermogonia immersed in the peripheral lobes, oblatly spheroidal, $80\ \mu$ tall, $120\ \mu$ in diameter, neck $30\ \mu$ long; wall $10\ \mu$ thick; spermatophores $30\ \mu$ long, about $2\ \mu$ in diameter, septate; spermatia bacilliform, about $6 \times 1\ \mu$.

MAURITIUS: *Robillard*, sub *P. perlata* v. *olivetorum* Nyl. det. Müll. Arg. at Farlow Herb.

MADAGASCAR: East Imerina, Andrangolaoka, J. M. Hildebrandt, Nov. 1880, sub *P. proboscidea* v. *corallina* Müll. Arg. ex hb. Sbarbaro at Farlow Herb.

CAPE OF GOOD HOPE: Table Mt., A. E. Eaton, Venus Transit Exp.; Kentani District, 320 m., on *Acacia horrida*, Alice Pegler, fragment: both at Kew.

PARMELIA (HYPOTRACHYNA) RETERIMULOSA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:520. 1926.

Type: South Africa, Natal, Drackenberg, Van Reenens Pass, 1700–1750 m., saxicole, *Brunnthaler*.

Thallus glaucous green (deep olive buff to wood brown in our specimens), 7 cm. in diameter, peripheral lobes 20 mm. long, 10 mm. wide, branching irregular, dissected into lobules 3–4 mm. wide, 2–4 mm. long, sinuses rounded to excised, narrowly black margined, cilia short 0.5–1 mm. long; surface minutely rimulose reticulate in the central portions, less so on the marginal lobules; soredia capitate on margins of central lobes, distant to close and subconfluent; underside black, shading to bistre or darker at the margins, densely rhizinoe, rhizinae branched, shorter and papilliform at the margins of the lobules; upper cortex $16\text{--}20\ \mu$ thick, fastigiate, hyphae $4\ \mu$ in diameter, lumina about $1\ \mu$; algal layer $15\text{--}20\ \mu$ thick, of close discrete colonies of *Trebouxia*, $15\text{--}20\ \mu$ in diameter, cells 6–7 μ ; medulla K yellow, then irregularly rufescent, C–, KC–, $55\text{--}65\ \mu$ thick, of closely woven, thickwalled, longitudinal hyphae, $3\ \mu$ in diameter, a little looser at the bottoms of the cracks through the upper cortex and algal layer, and just above the lower cortex; lower cortex black, $16\text{--}23\ \mu$ thick, of fastigiate pseudoparenchyma, growing out as rhizinae $30\text{--}35\ \mu$ in diameter.

Apothecia rare, not pedicellate, urceolate becoming nearly plane, up to 12 mm. in diameter, exciple smooth becoming reticulate rugose, margin thin, involute; disc chestnut; amphithelial cortex about $30\ \mu$ thick above to $40\text{--}48\ \mu$ thick below, fastigiate of thickwalled hyphae up to $8\text{--}9\ \mu$ in diameter; algal layer about $10\ \mu$ thick of very scattered colonies; algal layer under the parathecium $22\text{--}25\ \mu$ thick, nearly continuous, cells $11\text{--}17\ \mu$ in diameter ($38\text{--}40\ \mu$ fide Steiner & Zahlbr.); parathecium $30\ \mu$ thick, similar in structure to the amphithelial cortex; hypothecium $15\text{--}20\ \mu$ thick, of very slender, periclinal hyphae; thecium $40\text{--}57\ \mu$ tall; paraphyses $1.5\text{--}2\ \mu$ in diameter, branched above the asci, tips clavate to capitate in the brownish epithelial gel; asci broadly clavate, $38\text{--}50 \times 15\text{--}19\ \mu$, 8-spored, wall thickened at the tip; ascospores ellipsoid, $9.5\text{--}14 \times 6.5\text{--}9\ \mu$, epispore scarcely $1\ \mu$ thick.

The characters of the apothecia and paraphyses above are translated from the original description. Our specimens were sterile except for a loose fragment 1 mm. square. Such characters as were observable agree closely with the original description except for a thinner algal layer under the parathecium with somewhat smaller cells. Our specimens are often moribund and discolored from too slow drying, i.e. the surface is slightly mouldy in places. Our Tanganyika and Uganda specimens have the thallus and medulla K-, the others K yellow becoming irregularly rufescent.

CONGO: Kahusi, 2700 m., corticole, *F. L. Hendrickx* 4303, 4305, 4316, 4322 in E. African Herb.

KENYA: buffalo country south of Navossaro, 1610–2250 m., on orchid roots, *Anita Grosvenor Curtis* 700d, in Dodge Herb.; northeast side of Mt. Elgon, 2575 m., *A. Burnet* L31, in Makerere Coll. Herb.

UGANDA: Kigezi, Echuya, 2580 m., saxicole, *I. R. Dale* L59 p. p. min.; Mafuga, 2415 m., *I. R. Dale* L50 p. p. min., moribund fragments; Naiguru Ridge, 2250–2580 m., corticole, *I. R. Dale* L48a, all at Kew.

TANGANYIKA: without locality, tangled with hepatics, *Braun* ex B. L. Institut Amani 8602, in E. African Herb.; E. Usambara, Bomale near Amani on quinine trees in comparatively dry situations, growing over mosses, *R. E. Moreau & William Moreau*, at Kew, juvenile.

NYASALAND: Mlanje District, Lucheniya Plateau, Mt. Mlanje, 1860 m. on exposed branches of trees in rain forest, *L. J. Brass* 16452, Vernay Nyasaland Exp., in Dodge Herb.

CAPE OF GOOD HOPE: without locality, *C. H. Hitchcock*, in Tuckerman herb. sub *P. perforata* "lobi dein crenato-lobulati, subtus hispidi! CaCl non tingitur, K flavescit nec CaCl rubet nisi sero" at Farlow Herb.; Swellendam, [*Drège*] 94, Mars 1827, moribund fragment at Kew.

PARMELIA (*HYPOTRACHYNA*) *ornata* (Hue) Dodge, comb. nov.

Parmelia acanthibifolia f. *ornata* Hue, Nouv. Arch. Mus. [Paris] IV. 1:171. 1899.

Type: not designated. Réunion, Salazia, corticole, *Rodrigues*; Mauritius, *Rodrigues*.

Thallus 10–15 cm. in diameter, deep olive buff, lobes 10–15 mm. wide, very irregularly and deeply crenate with deep excised sinuses, forming large lobules 2 mm. wide at the base, 5 mm. wide above, about 10 mm. long, and much smaller lobules bearing soralia, margins smooth, irregularly short ciliate, cilia 0.5 (–1) mm. long; upper surface deeply rimose areolate in older portions, not in younger; soralia capitate, spherical, sessile on the margins or on small lobules up to 1 mm. long, 0.5–1 mm. in diameter, soredia coarsely granular; underside black to the margin or sometimes chestnut brown, completely covered by rhizinae up to 1 mm. long, simple, or occasionally dichotomous; upper cortex 20 μ thick, of fastigate pseudoparenchyma, cells 6 μ in diameter, thickwalled, conglutinate, interrupted by cracks penetrating the algal layer; algal layer 20 μ thick, continuous, cells 6–8 μ in diameter, often in columns between vertical medullary hyphae but not filamentous; medulla K yellow, then deep orange (finally blood red fide Hue), C-, KC-, 75 μ thick, of closely woven, longitudinal hyphae, 2–3 μ in diameter, very heavily nubilated with grayish granules, tearing easily from the lower cortex on sectioning; lower cortex 15 (–25) μ thick, black, pseudoparenchymatous from longitudinal hyphae; rhizinae 50–55 μ in diameter, branched.

Apothecia stipitate, stipe up to 3 mm. long, about 1 mm. in diameter, remaining

cupulate, 2-5 (-10) mm. in diameter, margin entire, exciple minutely white punctate and reticulate at first, then margin and upper part of the exciple developing spherical soralia in an almost continuous crust, disc very concave, tawny; amphithelial cortex 40-50 μ thick, similar in structure to the thalline cortex but cells somewhat larger, not sharply differentiated from the algal layer below as the algal cells push up between the crushed cortical hyphae to form the soredia; algal layer under the parathecium 15 μ thick, of colonies of *Trebouxia*, forming a nearly continuous layer; parathecium 30 μ thick, of fastigate pseudoparenchyma, hyphae very thickwalled, conglutinate, protoplasts spherical, 1-2 μ in diameter; hypothecium of very thickwalled periclinal hyphae, very closely woven, about 2 μ in diameter; thecium 80-90 μ tall; paraphyses about twice dichotomous above the asci, tips clavate, up to 4-5 μ in diameter, ending within the brownish epithelial gel; asci clavate, 60 \times 20 μ , wall 3 μ thick when young, tips 6 μ thick, 8-spored; ascospores ellipsoid, (13-) 15 \times 8-9 (-10) μ , with a moderately thick episore.

MAURITIUS: without locality, *Dr. Wight* in Taylor Herb., glued to sheet with *P. cristifera* Taylor, recognized as different by Taylor but not named, at Farlow Herb.; *W. Bojer*, Herb. Hookerianum at Kew.

CAPE OF GOOD HOPE: without locality, *C. H. Hitchcock* sub *P. perforata* in Tucker-man Herb. at Farlow Herb.

PARMELIA (HYPOTRACHYNA) Sanctae-Helenae Dodge, sp. nov.

Type: St. Helena, *J. C. Meliss* 9, at Kew.

Thallus ad 6 cm. diametro, brunneus, apicibus obscure olivaceo-alutaceus, lobis irregulariter dichotomis, centralibus 10 \times 3 mm., subpinnatis, lobulis ultimis 1 \times 0.5 mm., apicibus rotundatis subtruncatisve, sinibus rotundatis; sorediis capitatis, granulosis, in lobulis ultimis; lobis periphericis 20 \times 1.5 mm., lobulis ultimis 3 \times 1 mm., truncatis subretusisve, esorediosis; ciliatus, cilia 1-2.5 mm. in lobis centralibus, 0.5 mm. in lobis periphericis, superne rimoso-areolatus, K subflavescens, C-, KC flavescens; inferne niger, reticulatim rugulosus, rhizinis brevibus, dichotomis; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3-4 μ diametro; stratum algarum 15 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 3-4 μ diametro, granulis griseis nubilatis; medulla K flavens dein rubescens, C-, KC flavens dein rubescens, 20-25 μ crassitudine, hyphis longitudinalibus nubilatis, dense contextis; cortex inferior 12-13 μ crassitudine, fastigiatus, gelifactus.

Apothecia 5-6 mm. diametro, urceolata, marginibus involutis, subcrenulatis, excipulo laevi, albo-reticulato dein soredioso, disco castaneo, concavo, imperforato; cortex amphithelialis 30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 7-8 μ diametro, granulis griseis nubilatis; stratum algarum 30 μ crassitudine, subcontinuum, cellulis 6 μ diametro; medulla densa, granulis griseo-brunneis nubilata; stratum algarum sub parathecio 20 μ crassitudine, continuum; parathecium 15 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis 2.5 μ diametro; hypothecium 20 μ crassitudine, hyphis tenuibus, periclinalibus; thecium 40 μ altitudine; paraphyses septatae, semel bisve dichotomae super ascos, ramis moniliformibus, apicibus non incrassatis; asci cylindrici dein late clavati, 30 \times 12 μ ; ascosporae octonae, late ellipsoideae, 11 \times 6 μ , episporio tenui.

Thallus up to 6 cm. in diameter, wood brown, shading toward deep olive buff at the tips, lobes irregularly dichotomous, central lobes 3 mm. wide, 10 mm. long, with short internodes, appearing subpinnate, ultimate lobules about 0.5 mm. wide, 1 mm. long, tips rounded to subtruncate, sinuses rounded; peripheral lobes 1.5 mm. wide, 20 mm. long, divaricately dichotomous, internodes 2–3 mm. long, ultimate lobules about 1 mm. wide, 3 mm. long, tips truncate to slightly retuse, all closely ciliate, cilia 1–2.5 mm. long on central lobes, only about 0.5 mm. long on peripheral lobes; soralia capitate, on tips of the lobules on the central lobes, spreading to the adjacent upper surface, absent on the peripheral lobes, soredia granular; upper surface rimose areolate on central lobes, K yellowing slightly, C bleached to white, KC clearer yellow; underside black, reticulate rugulose, densely rhizinose in the center, sparsely so towards the tips of the lobes, rhizinae short, dichotomous; upper cortex 20 μ thick, of fastigate pseudoparenchyma, cells 2–3 μ in diameter, the upper half greenish brown; algal layer 15 μ thick, of small discrete colonies of *Trebouxia*, cells 3–4 μ in diameter, very heavily nubilated with grayish granules; medulla K yellow then red, C–, KC yellow then red, 20–25 μ thick, of densely woven longitudinal hyphae, heavily nubilated with grayish-brown granules; lower cortex 12–13 μ thick, fastigate, highly gelified.

Apothecia 5–6 mm. in diameter, urceolate, margin inrolled, slightly crenulate, exciple smooth, white reticulate, becoming sorediate, disc deeply concave, imperforate, chestnut; amphithecial cortex 30 μ thick, fastigate of thinwalled pseudoparenchyma, cells 7–8 μ in diameter, nubilated with grayish granules, interrupted where columns of algal cells push out to the surface to form soredia; algal layer 30 μ thick, subcontinuous, cells 6 μ in diameter; medulla dense, heavily nubilated with grayish brown granules; algal layer under the parathecium 20 μ thick, continuous, cells densely packed; parathecium 15 μ thick, gelified, of fastigate pseudoparenchyma, lumina 25 μ in diameter; hypothecium 20 μ thick, of periclinal, slender hyphae, deeply staining, thecium 40 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches moniliform, tips not thickened, ending 8 μ below the surface of the pale brownish epithelial gel; asci cylindric, becoming broadly clavate, 30 \times 12 μ , 8-spored; ascospores broadly ellipsoid, 11 \times 6 μ with a thin epispore.

The medullar reactions are somewhat variable. *Burbell* 237 has the medulla KC–, *Borden* 104 has the medulla KC yellow fading, *Menzies* has the medulla now K–, C–, KC–, although Tuckerman states on his label for one thallus, "K rubescit, C–," for the other "K–, C subrubescit." *Burbell* 237 states on the label C+, presumably pink but it is now C–. Only field work can determine whether these are ecologic variants.

A third plant glued to the sheet with the other *Menzies* specimens has broader, more rounded lobes, 30 mm. broad, 15 mm. long, with some small digitate lobules, many lobes capitate sorediate becoming confluent. It agrees with the other two in microscopic characters.

ST. HELENA: *J. C. Melliss* 9, type, 10 p. p. majore, 25, all corticole, 85, saxicole; *Burbell* 227, 237; all at Kew; *Menzies* ex hb. *Menzies* sub *P. perlata* in Tuckerman Herb. on sheet with *P. laevigata* but not so labeled in Farlow Herb.

FERNANDO PO: Santa Isabel Peak, 2575 m., on stones, *Gustavo Mann* at Kew.

ASCENSION ISLAND: Green Mountain on dead wood, *G. Borden 104* at Kew.

TRISTAN DA CUNHA: Challenger Exp. 3 collections; *John McGillivray*, *Voy. Herald*; all at Kew.

PARMELIA (HYPOTRACHYNA) *Lythgoeana* Dodge, sp. nov.

Parmelia tiliacea v. *hypoleuca* Müll. Arg., Bot. Jahrb. [Engler] 20:257. 1894, non *P. hypoleuca* Muhlenberg.

Type: Ethiopia, Chokke Mts., 10° 40' N., 37° 45' E., wood behind Camp I, 3220 m., ramulicole, *J. N. Lythgoe 17a*, C.B.E.E. at Kew. *P. tiliacea* v. *hypoleuca* Müll. Arg. was based on Tanganyika, Usambara, corticole, *Holst 787* p. p.

Thallus ca. 3 cm. longitudine, 2 cm. latitudine, ramulos involvens, dilute glaucus, lobis periphericis ca. 5 mm. longitudine, 10 mm. latitudine, semiorbicularibus, marginibus crenatis, sinibus acutis, raro rotundatis, centro rubrugulosus, marginibus eciliatis, laevibus; inferne dilute alutaceus, rhizinis confertis, obscuris, brevibus, tenuibus; cortex superior 6 μ crassitudine, cellulis isodiametricis, 3 μ diametro, pachydermeis, subirregulariter dispositis; stratum algarum 65 μ crassitudine, continuum, cellulis 6-7 μ diametro; medulla K-, C-, KC-, 90-105 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, luminibus 2 μ ; cortex inferior pallidus, non bene evolutus.

Apothecia 2 mm. diametro, substipitata, marginibus inflexis, subcrenulatis, excipulo laevi, subnitido, disco concavo, brunneo; cortex amphithecialis 55 μ crassitudine, fastigiatus gelifactusque, hyphis aliquando dichotomis, anastomosantibusque, luminibus ca. 1 μ diametro, 3-4 μ longitudine; stratum algarum coloniis *Trebouxiae* ad 30 μ diametro, discretis sparsisque et cellulis singulis; stratum algarum sub parathecio continuum, 25-30 μ crassitudine; parathecium 30-40 μ crassitudine, pseudoparenchymatice fastigiatus, protoplastis subsphaericis, 2.5-3 μ diametro; hypothecium 30 μ crassitudine, hyphis tenuibus, septatis, periclinalibus; thecium 60 μ altitudine; paraphyses septatae, super ascos semel bisve dichotomae, apicibus non incrassatis; asci clavati, ca. 30 \times 8 μ , apicibus subincrassatis; ascospores ellipsoideae, 8 \times 5 μ , (immaturae), episporio crasso.

Thallus about 3 cm. long, 2 cm. wide, closely wrapped around twigs, very pale glaucous, peripheral lobes about 5 mm. long, 10 mm. wide, semicircular, margins crenate, smooth, eciliate, sinuses acute, rarely slightly rounded, rarely very slightly lobulate, center somewhat rugulose, without isidia or soredia; underside pale buff, densely covered with short, dark rhizinae, branched at the tips; cortex scarcely differentiated, about 6 μ thick, of isodiametric cells 3 μ in diameter, thickwalled, somewhat irregularly arranged; algal layer 65 μ thick, continuous, of very closely packed cells 6-7 μ in diameter, with an occasional cell deeper in the medulla; medulla K-, C-, KC-, 90-105 μ thick, of very closely woven predominantly longitudinal hyphae 3 μ in diameter, lumen 2 μ ; lower cortex scarcely differentiated except the outermost hyphae are more closely septate into nearly isodiametric cells; rhizinae 35 μ in diameter, formed from a fascicle of medullary hyphae growing downward, the outer hyphae very pale brown, the rest hyaline.

Apothecia 2 mm. in diameter, cupulate, substipitate, margins inflexed, slightly

crenulate, exciple smooth, subnitid, disc concave, burnt sienna; amphithecial cortex $55\ \mu$ thick, fastigiate, gelified, hyphae sometimes dichotomous and anastomosing, lumina $1\ \mu$ in diameter, $3\text{--}4\ \mu$ long; algal layer of very scattered colonies up to $30\ \mu$ in diameter with many single cells; medulla of closely woven periclinal hyphae; algal layer under the parathecium $25\text{--}30\ \mu$ thick, continuous, with occasional cells or small colonies pushing up into the lower part of the parathecium; parathecium $30\text{--}40\ \mu$ thick, of fastigiate pseudoparenchyma, protoplasts subspherical, $2.5\text{--}3\ \mu$ in diameter; hypothecium $30\ \mu$ thick, of slender, septate hyphae, the lower half deeply staining, the upper half scarcely so; thecium $60\ \mu$ tall; paraphyses simple or once or twice dichotomous, septate, tips not thickened, ending about $5\ \mu$ below the surface of the brownish epithelial gel; asci clavate, about $30 \times 10\ \mu$, 8-spored, tips only slightly thickened; ascospores ellipsoid, about $8 \times 5\ \mu$, with a moderately thick episore (perhaps still immature, ascospores still in the ascus and only a few asci seen).

ETHIOPIA: Chokke Mts., $10^\circ 40' N.$, $37^\circ 45' E.$, north of Debra Marcos, wood behind Camp I, 3220 m., ramulicole, *J. N. Lythgoe 17a*, type *17b*, C.B.E.E., at Kew.

PARMELIA (HYPOTRACHYNA) *Menziesii* Dodge, sp. nov.

Type: Cape of Good Hope, *A. Menzies* sub *P. perforata* in Tuckerman Herb. at Farlow Herb.

Thallus 6 cm. diametro, cinnamomeo-alutaceus, K flavescens, lobis centralibus 10 mm. latitudine, pinnatim ramosis, sinibus rotundatis, periphericis rotundatis, 5 mm. longitudine, 10 mm. latitudine, dissectis, lobulis $1 \times 1\ \text{mm.}$, apicibus truncatis; superficie convexo, rimoso-areolato, eciliatus; inferne centro nigro, marginibus obscure castaneis, rhizinis longis, tenuibus; cortex superior $25\ \mu$ crassitudine, fastigiatus, cellulis $6 \times 4\ \mu$, conglutinatis, nubilatis; stratum algarum $20\ \mu$ crassitudine, coloniis discretis, confertis *Trebouxiae*, cellulis $6\text{--}7\ \mu$ diametro; medulla K flavescens dein rufescens, C-, KC- aut evanescenter flavidula, $50\ \mu$ crassitudine, hyphis longitudinalibus, granulis griseis dense nubilatis, conferte contextis; cortex inferior niger, $20\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis subsphaericis, $6\text{--}7\ \mu$ diametro, conglutinatis.

Apothecia urceolata, stipitata, 4–5 mm. diametro, margine minute crenulato, excipulo rimoso-areolato, disco rufo-aurantiaco subbrunneove; cortex amphithecialis $60\ \mu$ crassitudine, fastigiatus, gelifactus; stratum algarum $15\ \mu$ crassitudine, continuum; stratum algarum sub parathecio $40\ \mu$ crassitudine, continuum, granulis brunneis nubilatum; parathecium $30\ \mu$ crassitudine, fastigiatus; hypothecium $30\ \mu$ crassitudine, hyphis periclinalibus tenuibus contextum; thecium $70\ \mu$ altitudine; paraphyses tenues, super ascos dichotomae, apicibus non incrassatis; asci ellipsoidei, ca. $50 \times 20\ \mu$, pachydermei juventute; ascosporae octonae, ellipsoideae, $18\text{--}19.5 \times 9\ \mu$, episporio tenui.

Spermogonia oblate sphaeroidea, $130\text{--}160\ \mu$ diametro, $115\ \mu$ altitudine; perifulcrum $13\ \mu$ crassitudine, non bene distinctum; spermatophorae septatae, non ramosae, $90 \times 1\ \mu$; spermatia laterales ad septos, $5\text{--}6 \times 1\ \mu$.

Thallus at least 6 cm. in diameter, probably larger, clay color to cinnamon buff (1957), K yellow, C bleached to white, lobes about 10 mm. wide below, pinnately branched with rounded sinuses, narrowing to about 2 mm. below the peripheral

lobe which is rounded, 5 mm. long, 10 mm. broad, dissected into peripheral lobules about 1 mm. long and wide, tips truncate, sinuses 1 mm. wide; surface convex, deeply rimose areolate; eciliate although rhizinae often project beyond the margin, giving the appearance of cilia under low magnifications, not isidiose nor sorediose; underside black with dark chestnut margins; rhizinae long, slender in the center, papillate to the margin of some lobes, nude and reticulate rugulose at the margins of other lobes; upper cortex $25\ \mu$ thick, fastigate, cells conglutinate about $6 \times 4\ \mu$, nubilated with pale brownish granules in a greenish brown gel; algal layer about $20\ \mu$ thick, of discrete, close colonies of *Trebouxia* in a nearly continuous layer; medulla K yellow rufescent, fading to yellow, C-, KC faint yellow soon fading, $50\ \mu$ thick, of closely woven longitudinal hyphae, heavily nubilated with grayish granules except in the lower $10\ \mu$; lower cortex black, $20\ \mu$ thick, of fastigate pseudoparenchyma, cells subspherical, $6-7\ \mu$ in diameter, conglutinate.

Apothecia urceolate, short stipitate, 4-5 mm. in diameter, margin minutely crenulate, exciple rimose areolate, disc orange rufous to Sanford's brown; amphithecial cortex $60\ \mu$ thick, fastigate, gelified; algal layer $15\ \mu$ thick, continuous; algal layer under the parathecium $40\ \mu$ thick, continuous, cells more closely packed above, very heavily nubilated with brownish granules; parathecium $30\ \mu$ thick, fastigate, gelified; hypothecium $30\ \mu$ thick, of slender, periclinial hyphae, moderately closely woven, in a gel; thecium $70\ \mu$ tall; paraphyses slender, dichotomous above, tips not thickened, ending about $7\ \mu$ below the surface of the hyaline epithecial gel; asci ellipsoid, about $50 \times 20\ \mu$, thickwalled when young, thinning at maturity, 8-spored; ascospores ellipsoidal, $18-19.5 \times 9\ \mu$, with a relatively thin episore.

Spermogonia oblately spheroidal, $130-160\ \mu$ in diameter, $115\ \mu$ tall, wall slightly brownish, $13\ \mu$ thick, otherwise not differentiated from medullary hyphae; spermatophores septate, unbranched, $90 \times 1\ \mu$; spermatia bacilliform, $5-6 \times 1\ \mu$, borne laterally at the septa.

CAPE OF GOOD HOPE: *Menzies*, sub *P. perforata* in Tuckerman Herb., at Farlow Herb.

PARMELIA (HYPOTRACHYNA) COILOCARPA Stirton, Scot. Naturalist 4:202. 1877-8.

Type: Fernando Po, ramulicole, *G. Thomson*.

Thallus about 6 cm. in diameter, pallid neutral gray to almost white, peripheral lobes imbricate, about 2.5 mm. long, 1-2 mm. wide, subpinnately dichotomous, sinuses rounded, ultimate lobules 1-1.5 mm. long, up to 1 mm. wide, tips truncate or slightly rounded; surface smooth, shining, narrowly black margined, rather closely short ciliate, cilia 0.5 mm. long; underside black, shining, auburn on the lobules, densely rhizinose; rhizinae short, simple, densely branched at the tips to form minute holdfasts when in contact with the bark; upper cortex $40\ \mu$ thick, fastigate, of hyphae predominantly periclinial just above the algal layer, sending up vertical branches, conglutinate, dichotomous in the middle, branches moniliform, cells $5-6\ \mu$ in diameter, heavily nubilated with brownish granules; algal layer $20\ \mu$ thick, continuous, cells $5-6\ \mu$ in diameter; medulla K yellow then red, C-, KC-, $80\ \mu$ thick, of closely woven longitudinal hyphae, heavily nubilated with grayish

granules, more loosely woven next the lower cortex; lower cortex $15\ \mu$ thick, dark brown, of fastigate pseudoparenchyma, cells $4-5\ \mu$ in diameter with moderately thick walls; rhizinae $55\ \mu$ in diameter, formed by outgrowth of cells of lower cortex.

Apothecia $7-12\ \text{mm.}$ in diameter, margin incurved, entire or nearly so, exciple foveolate impressed; ascospores $24-34 \times 12-17\ \mu$. Spermatia nearly cylindric, straight, $5-5.8 \times 0.65-0.8\ \mu$.

Our specimen is sterile and the description of the apothecia is translated from Stirton. We have referred our plant here on the basis of its biochemical reactions as Stirton's description of the thallus is inadequate for certain identification.

GUINÉE FRANÇAISE: Macenta, 645-805 m., on bare rock at top of hill, J. T. Baldwin 9849a, at Kew.

PARMELIA (HYPOTRACHYNA) OWANIANA Stirton, Trans. Glasgow Soc. Field Nat. 5:213. 1877; fuller description based on type by Gyelnik, Ann. Mus. Nat. Hungar. Bot. 31:33. 1938.

Type: Cape of Good Hope, Somerset East, P. MacOwan.

Thallus at least $3-4\ \text{cm.}$ in diameter, between deep olive buff and avellaneous, peripheral lobes about $15\ \text{mm.}$ long, $2-8\ \text{mm.}$ wide, imbricate, irregularly dichotomous, tips sometimes rounded, $8\ \text{mm.}$ in diameter, margins crenate with rounded sinuses and very rare cilia $0.2-0.4\ \text{mm.}$ long, central lobes smaller, sometimes lacerate and subsidiose, surface white reticulate and minutely rimulose areolate, becoming minutely subscrobiculate toward the center, rarely somewhat verrucose, the verrucae elongating and becoming soredioid; underside black, densely rhizinose, margins of tips of lobes chestnut with black papillae or nude, shining, minutely reticulate rugulose in the outer $2\ \text{mm.}$; upper cortex $15\ \mu$ thick, of fastigate pseudoparenchyma, cells relatively thinwalled, apparently not gelified as algal cells push up between the cortical cells; algal layer $15\ \mu$ thick, nearly continuous, cells up to $8\ \mu$ in diameter; medulla K yellow, then orange red, C-, KC- [Gyelnik l.c. states: KC rubescens], $55\ \mu$ thick, loosely woven, of predominantly longitudinal hyphae, about $3\ \mu$ in diameter, rather thinwalled; lower cortex $8-11\ \mu$ thick, brown, of rather thinwalled fastigate pseudoparenchyma, becoming somewhat thinner on the margin, of longitudinal hyphae with isodiametric cells; rhizinae $40\ \mu$ in diameter, formed from the outgrowth of hyphae of the lower cortex.

Apothecia (3-) 5 (-9) mm. in diameter, margin thin, subcrenate, exciple rugose-venose to subfoveolate; disc fusco-rufous; ascospores $12-14 \times 8-10\ \mu$.

Although sterile, our specimen agrees with Stirton's and Gyelnik's description of the type except for the reaction with KC. The species is somewhat intermediate between sect. *Hypotrachyna* and subg. *Amphigymnia*.

TRISTAN DA CUNHA: Inaccessible Island, Voy. Challenger, at Kew.

PARMELIA (HYPOTRACHYNA) angolensis (Vainio) Bijl, Ann. Univ. Stellenbosch A 9:3:13. 1931.*

Parmelia gracilescens v. *angolensis* Vainio, Cat. Welwitsch African Pl. 2:401. 1901.

* Technically Bijl did not make a formal new combination here, as he neither cited the name-bringing synonym nor described the taxon. So far as I can discover, the formal combination is made here for the first time.

Type: Angola, Huila, Serra da Chela, 1225–1775 m., ramulicole, *Welwitsch* 30 p. p.; Morro de Lopollo, *Welwitsch* 31, fertile.

Thallus about 5 cm. long, 2 cm. wide, olive buff, lobes about 2 mm. wide below, 20 mm. long, irregularly dichotomous with rounded sinuses, ultimate lobules 3 mm. long, 1.5 mm. wide, tips truncate or nearly so, suberect; underside black, densely rhizinose, rhizinae repeatedly branched in the distal portion; upper cortex 20 μ thick, of fastigate pseudoparenchyma, protoplasts about 1 μ in diameter, somewhat irregularly arranged, heavily nubilated with brownish granules; algal layer 15 μ thick, continuous or interrupted, colonies of *Trebouxia* 15 μ in diameter, cells 5–8 μ ; medulla K–, C–, KC–, 55 μ thick, of predominantly longitudinal hyphae, moderately closely woven, heavily nubilated with hyaline granules; lower cortex 15 μ thick, black, of three layers of nearly isodiametric cells from longitudinal thickwalled hyphae.

Apothecia up to 10 mm. in diameter, cupulate becoming nearly plane, margin entire, inflexed, becoming crenulate, exciple smooth, becoming minutely rugulose, disc chestnut, imperforate; amphithecial cortex 40–55 μ thick, fastigate, hyphae 7 μ in diameter, protoplasts 1–2 μ in diameter, spaced about 3 μ apart; algal layer 30–40 μ thick, nearly continuous, cells up to 6 μ in diameter; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium 20 μ thick, continuous; parathecium 20 μ thick, of very small celled fastigate pseudoparenchyma; hypothecium 15 μ thick, of conglutinate slender, periclinal hyphae; thecium 65 μ tall; paraphyses slender, several times dichotomous above the asci, tips clavate, 5 μ in diameter, nearly reaching the surface of the brownish epithelial gel; asci clavate, about 40×12 μ , tip thickened when young; ascospores short ellipsoid, $10\text{--}13 \times 7\text{--}8$ μ .

Spermogonia immersed, oblate sphaeroidal, 80 μ tall, 170 μ in diameter; wall brown, 10 μ thick, pseudoparenchymatous from periclinal hyphae; spermatophores about 40×1 μ , unbranched (or branched at the base); spermatia bacilliform, straight, about 6×0.6 μ .

CAMEROONS: Cameroon Mt., collector not given, handwriting resembles that of Gustavo Mann, evidently sent Nylander as no. 7, but his identification not recorded with the specimen, identified as *P. acanthifolia* Pers. by Müller Argau, at Kew.

PARMELIA (HYPOTRACHYNA) DUCALIS Jatta, Ann. di Bot. 6:407. 1908.

Type: Uganda, Mt. Elgon, Bujongolo, valle Bokoku, 3800 m.; Nubitava opposite Kichuchu, 3000 m.; Duroi, west slope of Valle del Laghi, all *Duke Abruzzi*.

Thallus white to pale gull gray, lobes at least 20×6 mm., dichotomous to subpinnate, ultimate lobules $3\text{--}4 \times 2$ mm.; underside black to margin, very densely rhizinose, rhizinae 1 (–2) mm. long, branched near the tips, extending beyond the margins and appearing as cilia under low magnifications; upper cortex 40 μ thick, of fastigate pseudoparenchyma, the outer half very heavily nubilated with brown granules; algal layer about 30 μ thick, a nearly continuous layer of colonies of *Trebouxia*, cells 7–8 μ in diameter; medulla K–, C–, KC– to slowly and faintly ferruginous, 165–300 μ thick, of longitudinal, very thickwalled hyphae, very densely woven but not conglutinate, heavily nubilated with white granules; lower

cortex black, 25 μ thick, pseudoparenchymatous, cells irregularly arranged, walls dark brown, moderately thick.

Apothecia sessile, urceolate, 6–15 mm. in diameter, exciple pale, slightly rugulose, disc fuscous, somewhat pruinose, perforate; amphithecial cortex 50–65 μ thick, highly gelified and less clearly fastigate than the thalline cortex; algal layer 50 μ thick, colonies more discrete; algal layer under the parathecium continuous, 25 μ thick; parathecium 25 μ thick, similar in structure to the amphithecial cortex with somewhat larger lumina; hypothecium 13 μ thick, of very slender periclinal hyphae; thecium 50 μ tall; paraphyses slender, septate, tips slightly clavate, ending in the brownish epithelial gel; asci 8-spored, cylindric clavate, 30–35 \times 9–10 μ ; ascospores ellipsoid, 8–9 \times 3–4 μ , with rather thick episporio.

Thomas 167 consists of a single sterile primary lobe, parasitized at the base, separated from other lichens. *Hendrickx 3703* is a more ample collection, but moribund with a single apothecium 7 mm. in diameter, with inrolled margin. The thecium has been eaten away over most of the surface and is regenerating over about half, apparently from the hypothecium.

CONGO: Mt. Kahusi and Kahushwha, on rock, *F. L. Hendrickx 3703*; Mt. Kahusi, 2700 m., on twigs, *F. L. Hendrickx 4314* p. p. min., both in E. African Herb.; north slope of Mt. Karisimbi, Camp Lukumi, muscicole, *Derscheid 2499a*, Exp. Harvard Inst. Trop. Med. 1926-7, at Farlow Herb.

UGANDA: Imatory Mts. between Ibahin 1960 m. and Itibol 2060 m., on rocks, *A. S. Thomas 167* p. p. min. at Kew; Karamoja District, Napak, 2250 m., on rock, *A. S. Thomas 3630* in E. African Herb.; Sese, Towa forest, on rocks in grassland, 1225 m., *A. S. Thomas 3023* p. p. min. at Kew; Kigezi, Naiguru Ridge, 2250–2575 m., corticole, *I. R. Dale L47* p. p. min. a small fragment, at Kew.

NYASALAND: Nchisi Mt., 1400 m., on dry rocks in *Brachystegia* woodland, *L. J. Brass 16919*, Vernay Nyasaland Exp. in Dodge Herb.

PARMELIA (HYPOTRACHYNA) kahusiensis Dodge, sp. nov.

Type: Congo, Mt. Kahusi, 2700 m., on twigs and small branches, *F. L. Hendrickx 4300*, in East African Herb.

Thallus 4–6 cm. diametro, pallide olivaceo-alutaceus, lobis ad 30 \times 5 mm., irregulariter dichotomis subpinnatisve, sinibus excisis, lobulis ultimis ca. 2 mm. longitudine, 2–3 mm. latitudine, apicibus subtruncatis retusisve; infra niger, rhizinis ramosis, densis, 50 μ diametro; cortex superior 13–16 μ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, nubilatus; stratum algarum coloniis discretis *Trebouxiae*, 13–16 μ diametro; medulla K–, C–, KC–, 30–35 μ crassitudine, hyphis longitudinalibus compacte intertextis; cortex inferior 15 μ crassitudine, nigerrimus, pseudoparenchymatice fastigiatus.

Apothecia substipitata, ad 7 mm. diametro, margine integro dein crenato, inflexo, excipulo laevi dein subrugoso, roseo-alutaceo, disco cinnamomeo-alutaceo dein sepiaceo; cortex amphithecialis 26–29 μ crassitudine, fastigiatus, gelifactus; stratum algarum sub cortice non bene evolutum, sub parathecio 50–65 μ crassitudine, continuum; parathecium 25 μ crassitudine, fastigiatum; hypothecium ca. 10 μ crassitudine, hyphis tenuibus periclinalibus; thecium 55 μ altitudine; paraphyses tenues, apicibus non incrassatis; asci late clavati subellipsoidei, 20–23 \times 10 μ ; ascospores octonae, distichae, ellipsoideae, 7 \times 5 μ , episporio crasso.

Thallus pale olive buff, 4–6 cm. in diameter, lobes up to 30 \times 5 mm. closely and subirregularly dichotomous, appearing subpinnate, sinuses excised, ultimate

lobules 2-3 mm. wide, about 2 mm. long, tips subtruncate to retuse; underside black with very dense branched black rhizinae, 50 μ in diameter; upper cortex 13-16 μ thick, gelified and nubilated with brownish granules, apparently of fastigate pseudoparenchyma, interrupted by minute cracks through the algal layer, 10-12 μ wide; algal layer of discrete colonies of *Trebouxia*, 13-16 μ in diameter; medulla K-, C-, KC-, 30-35 μ thick, of closely woven longitudinal hyphae with small air spaces under the algal colonies; lower cortex 15 μ thick, very black, apparently of fastigate pseudoparenchyma.

Apothecia substipitate, up to 7 mm. in diameter, margin entire at first becoming crenate, inrolled, exciple smooth, finally slightly rugose, pinkish buff, disc cinnamon buff when young, finally sepia; amphithecial cortex 26-29 μ thick, outer 10 μ brownish, the rest hyaline, fastigate, highly gelified; algal layer not well developed under the cortex but under the parathecium 50-65 μ thick, continuous, of densely packed cells; parathecium 25 μ thick, fastigate, gelified; hypothecium about 10 μ thick, of slender, thickwalled periclinal hyphae; thecium 55 μ tall; paraphyses slender, tips not thickened, ending in the thin brownish epithelial gel; asci broadly clavate to subellipsoid, 20-23 \times 10 μ , 8-spored; ascospores distichous, ellipsoid, 7 \times 5 μ , with moderately thick epispore.

Hendrickx 4305 from the type locality may belong here, but the lobes are somewhat narrower and sterile. *Hendrickx 4314* p. p. min. is a moribund fragment.

CONGO: Mt. Kahusi, 2700 m., on twigs and small branches, *F. L. Hendrickx 4300*, type, *4305, 4314* p. p. min. all in E. African Herb.

KENYA: Endabarra, Mau forest, 2350 m., growing over mosses in *Acacia* grove, *P. R. O. Bally B4947* p. p. min. ex Coryndon Memorial Mus., at Kew.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small 217* p. p. min.; Karamoja, Mt. Morongole, 2575 m., corticole, *A. S. Thomas 3308* p. p. min.; Bunyoro, Busingoro, 1130 m., on *Poinsettia* bush, *I. R. Dale L51b*; Kigezi, saddle between Muhuvura and Mgahinga, 2900 m., corticole, *I. R. Dale L11c*, fragment; all at Kew.

NYASALAND: Nyika Plateau, 2300 m., on dead branches of *Philippia* trees, *L. J. Brass 17235*, in Dodge Herb.

PARMELIA (HYPOTRACHYNA) subplumbeata Dodge, sp. nov.

Type: Congo, Camp Lukumi on south slope of Mt. Karisimbi, 3460 m., growing over mosses, *Derscheid 2504*, Exp. Harvard Inst. Trop. Biol. Med. 1926-27, in Dodge Herb.

Thallus 3 cm. diametro, pallide griseo-olivaceous, lobis 20 \times 6-7 mm., semel vel bis dichotomis, marginibus lobulatis, lobulis ultimis, 2 \times 1 mm., apicibus truncatis, eciliatis, nigromarginatis; inferne niger, marginibus roseo-alutaceis; rhizinae breves, densae, ramosae, nigrae; cortex superior 16 μ crassitudine, fastigatus, gelifactus; stratum algarum 10 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 4-5 μ diametro, medulla K-, C-, KC flavens dein lente aurantiaca, 30-35 μ crassitudine, hyphis longitudinalibus 3-4 μ diametro, pachydermeis; cortex inferior 20 μ crassitudine, gelifactus, fastigiatus, dimidia parte externa nigrobrunnea.

Apothecia ad 6 mm. diametro, sessilia, basi constricta, marginibus integris, inflexis, excipulo laevi, cinnamomeo-alutaceo, disco subrufo, perforato; cortex amphithecialis 50 μ crassitudine, fastigiatus, gelifactus, hyphis sparsim septatis, luminibus 1 μ diametro; stratum algarum male evolutum; stratum algarum sub

parathecio 20–25 μ crassitudine, subcontinuum; parathecium 16 μ crassitudine, hyalinum, hyphis septatis, fastigiatum; hypothecium ca. 15 μ crassitudine, hyphis tenuibus periclinalibus; thecium 40 μ altitudine; paraphyses tenues, simplices, apicibus non incrassatis; asci clavati dein ellipsoidei, $30 \times 10 \mu$, pachydermei, apicibus incrassatis; ascospores octonae, sphaericae, 6 μ diametro, episporio crasso.

Thallus 3 cm. in diameter, light grayish olive, deep olive buff when moistened, lobes 20×6 –7 mm., once or twice dichotomous, ultimate lobules about 2×1 mm., tips truncate, eciliate, but rhizinae may show at the margins, narrowly black margined; underside black shading to pinkish buff at the margins, rhizinae short, dense, branched, black upper cortex 16 μ thick, fastigate, gelified, outer 6 μ brownish; algal layer 10 μ thick, of discrete colonies of *Trebouxia*, cells 4–5 μ in diameter, with an occasional cell deeper in the medulla; medulla K–, C–, KC yellow, slowly orange, 30–35 μ thick, of very closely woven longitudinal hyphae, 3–4 μ in diameter with very slender lumina; lower cortex 20 μ thick, gelified, fastigate, the outer half very dark brown.

Apothecia up to 6 mm. in diameter, sessile or substipitate, margin entire, inrolled, exciple smooth, cinnamon buff, disc auburn, finally perforate; amphithecial cortex 50 μ thick, fastigate, hyaline, highly gelified, hyphae rarely septate, lumina about 1 μ in diameter; algal layer represented by an occasional colony of 2–3 cells; algal layer under the parathecium 20–25 μ thick, nearly continuous; parathecium 16 μ thick, fastigate, hyaline, hyphae more septate than in the amphithecial cortex; hypothecium about 15 μ thick, of very slender periclinal hyphae; thecium 40 μ tall; paraphyses slender, unbranched, tips not thickened, ending near the surface of the brownish epithecial gel 10 μ thick; asci 8-spored, clavate becoming ellipsoidal, wall and tip thickened when young, $30 \times 10 \mu$; ascospores spherical, 6 μ in diameter, with a moderately thick episore.

A duplicate of the type was identified by Zahlbruckner as *P. plumbeata* Zahlbr. before publication in Handel-Mazzetti, Symb. Sinicae 3:189. 1930, but he did not cite the African specimen. Our species differs from *P. plumbeata* in much smaller algae (4–5 μ) in discrete colonies instead of cells 12–16 μ in a continuous layer; apothecia 6 mm. in diameter, disc perforate instead of 3 mm., disc imperforate, and in the medulla KC yellow, slowly orange instead of KC–.

CONGO: Camp Lukumi, on north slope of Mt. Karisimbi, 3460 m., growing over mosses, *Derescheid* 2504, Exp. Harvard Inst. Trop. Biol. Med. 1926–27, in Dodge herb.

PARMELIA (HYPOTRACHYNA) SENSIBILIS Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:522. 1926.

Type: Kenya, Burra, ramulicole, *Schroeder* 285.

Thallus wrapped around twigs, appressed and imbricate, at least 3.5×1.5 cm., olive buff to pale olive buff, marginal lobes 4–7 mm. long, 2–5 mm. wide, eciliate, crenate to minutely lobulate, sinuses narrow, rounded, irregularly dichotomous, surface smooth, minutely rugulose and rimulose in the center of larger lobes; underside black, densely rhizinose, minutely papillate at the margins; upper cortex 15 μ thick, of fastigate pseudoparenchyma, cells moderately thickwalled, rounded, heavily nubilated with brownish granules; algal layers 20 μ thick, continuous, cells 5–6 μ in diameter; medulla K yellow then orange red, C–, KC orange red, 75 μ

thick, of closely woven longitudinal hyphae, $3\ \mu$ in diameter, very heavily nubilated with grayish granules, somewhat more loosely woven and less nubilated next the lower cortex; lower cortex $8\ \mu$ thick, of fastigate pseudoparenchyma, protoplasts about $1\ \mu$ in diameter.

Apothecia urceolate, up to 3 mm. in diameter, margin entire, inflexed, exciple smooth, disc perforate, buckthorn brown; amphithecial cortex $15\ \mu$ thick, of fastigate pseudoparenchyma; algal layer $30\ \mu$ thick, continuous, cells $5\text{--}6\ \mu$ in diameter; medulla densely nubilated throughout; algal layer under the parathecium $15\ \mu$ thick, continuous; parathecium $30\ \mu$ thick, fastigate, gelified, lumina about $1\ \mu$ in diameter; hypothecium $20\text{--}22\ \mu$ thick, of very densely woven, slender, periclinal hyphae; thecium $45\ \mu$ tall; paraphyses slender, septate, once dichotomous above the asci, branches moniliform, tips not enlarged, ending $5\ \mu$ below the surface of the brownish epithelial gel; asci 8-spored, ellipsoid, $27\text{--}30 \times 10\text{--}11\ \mu$, tip about $6\ \mu$ thick; ascospores broadly ellipsoid, $8\text{--}11 \times 6\text{--}7\ \mu$, with a thick episore, subdistichous.

NYASALAND: Cholo Mt. 1200 m., in rain forest, ramulicole, L. J. Brass 17771, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (HYPOTRACHYNA) BRACHYPHYLLA Müll. Arg., Flora 69:256. 1886.

Type: S. Africa, Transvaal, Lydenburg, Wilms, com. Lahm.

Thallus about 5 cm. in diameter, citrine drab in the center, shading to deep olive buff at the margins, peripheral lobes 10 mm. long, 15 mm. wide, pinnately branched, main axis 2–3 mm. wide, slightly convex, sinuses rounded, tips truncate or rounded, ultimate lobules 1 mm. long, 1–1.5 mm. wide, eciliate; surface smooth, center somewhat rugose; underside black with dense black rhizinae; upper cortex $15\ \mu$ thick, of fastigate pseudoparenchyma, cells $3\text{--}4\ \mu$ in diameter; algal layer $25\ \mu$ thick, of discrete colonies of *Trebouxia*, cells $5\text{--}6\ \mu$ in diameter, between vertical medullary hyphae; medulla K slowly yellow (ochroleucous), C red above, negative next the lower cortex, KC red above, negative below, $100\ \mu$ thick, of loosely woven, thickwalled hyphae, $3\ \mu$ in diameter, not nubilated; lower cortex $13\ \mu$ thick, deep brown, pseudoparenchymatous from longitudinal hyphae; rhizinae $55\ \mu$ in diameter.

Apothecia 4–5 mm. in diameter, urceolate at first becoming nearly plane, margin crenulate, exciple smooth to impressed punctate, disc bay to chestnut; amphithecial cortex $40\ \mu$ thick, fastigate, the upper $15\ \mu$ similar to the thalline cortex, but more heavily nubilated with brownish granules and gelified, the rest of dichotomously branched vertical hyphae; algal layer of discrete colonies $20\ \mu$ in diameter, dying out below; algal layer under the parathecium $25\text{--}40\ \mu$ thick, cells $10\ \mu$ in diameter in a nearly continuous layer, mostly solitary; parathecium $30\ \mu$ thick, of fastigate pseudoparenchyma, rather thinwalled, protoplasts $3\text{--}4 \times 3\ \mu$, short ellipsoidal; hypothecium $30\ \mu$ thick, of loosely woven predominantly periclinal, thinwalled hyphae; thecium $65\ \mu$ tall; paraphyses slender, septate, about $2\ \mu$ in diameter, dichotomous above the asci, branches submoniliform, tips clavate, $6\text{--}7 \times 4\ \mu$, brown, thickwalled, reaching the surface of the brownish epithelial gel; asci cylindric-clavate, $40 \times 10\ \mu$, wall thin, tip $4\ \mu$ thick, 8-spored; ascospores ellipsoid, $6\text{--}10 \times 4.5\text{--}5.5\ \mu$, with a moderately thick episore.

Our material has somewhat larger lobes and much larger apothecia, but otherwise agrees with Müller Argau's description.

NORTHERN RHODESIA: Abercorn, growing over roots of *Tridactyle teretifolia* Schltr. on *Brachystegia taxifolia* in dense shade, A. A. Bullock 2105 pars, International Red Locust Control Service, at Kew.

CAPE OF GOOD HOPE: without more definite locality or collector, in Tuckerman herb. sub *P. tiliacea*, at Farlow Herb.

PARMELIA (HYPOTRACHYNA) *ganguellensis* Dodge, sp. nov.

Type: Angola, Benguela, country of Ganguelas and Ambuelas, corticole, J. Gossweiler, rec'd 1910, at Kew.

Thallus 7–8 cm. diametro, alutaceo-brunneus, laevis, lobis $20 \times 3-4$ mm., subimbricatis, apicibus rotundatis, crenatis, sinibus non excisis; infra niger, rugosus verrucosusque; cortex superior 13μ crassitudine, fastigiatus, granulis brunneis nubilatus; stratum algarum 50μ crassitudine, continuum, cellulis 8μ diametro, medulla K-, C-, KC-, $140-150 \mu$ crassitudine, hyphis longitudinalibus, superne densioribus, inferne laxioribus contextis, $3-3.5 \mu$ diametro; cortex inferior 15μ crassitudine, niger, pseudoparenchymaticus.

Apothecia 1–3.5 mm. diametro, margine inflexo, crenato, excipulo laevi, disco castaneo; cortex amphithecialis superne 130μ , inferne ad 42μ tenuescens, pseudoparenchymatice fastigiatus; stratum algarum $50-80 \mu$ crassitudine, continuum; medulla hyphis verticalibus laxius intertextis, nubilatis; stratum algarum sub parathecio 40μ crassitudine, coloniis *Trebouxiae*; parathecium 65μ crassitudine, fastigiatus; hypothecium 15μ crassitudine, hyphis tenuibus periclinalibus; thecium 60μ altitudine; paraphyses septatae, bis terve dichotomae super ascos, ramis moniliformibus; asci late clavati, pachydermei, $23 \times 13 \mu$; ascosporae octonae, ellipsoideae $7-8 \times 5-5.5 \mu$.

Thallus 7–8 cm. in diameter, smooth, buffy brown, lobes $20 \times 3-4$ mm., somewhat imbricate, tips rounded, crenate, axils not excised; underside black, closely verrucose and rugulose, rhizinose to the margin rhizinae mostly pulled off in collecting; upper cortex 13μ thick, fastigate, nubilated with brownish granules; algal layer 30μ thick, continuous, cells densely packed above, more scattered below, 8μ in diameter; medulla K-, C-, KC-, $140-150 \mu$ thick, of thickwalled, predominantly longitudinal hyphae, closely woven above, looser below, $3-3.5 \mu$ in diameter; lower cortex 16μ thick, pseudoparenchymatous.

Apothecia 1–3.5 mm. in diameter, margin inrolled, crenate, exciple smooth, disc chestnut; amphithelial cortex 130μ thick above, tapering to 42μ thick below, of fastigate pseudoparenchyma with very small lumina; algal layer $50-80 \mu$ thick, continuous; medulla of predominantly vertical hyphae, more loosely woven than in the thalline medulla, somewhat nubilated with brownish granules; algal layer under the parathecium 50μ thick, of discrete colonies of *Trebouxia*; parathecium 65μ thick, similar to the amphithelial cortex in structure but with larger lumina; hypothecium 15μ thick, of slender interwoven hyphae; thecium 60μ tall; paraphyses septate, twice to thrice dichotomous above the asci, branches moniliform, imbedded in the epithelial gel, brownish in the upper 10μ ; asci broadly clavate, thickwalled with a thicker tip, $23 \times 13 \mu$; ascospores short ellipsoidal, $7-8 \times 5-5.5 \mu$.

The Northern Rhodesian specimen is larger and more mature than the type, growing over orchid roots, less appressed to the substrate, lobes somewhat more irregular.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, corticole, J. Gossweiler, rec'd 1910, type, at Kew.

NORTHERN RHODESIA: without locality, growing over orchid roots on bark, A. A. Bullock 20 Sept. 1949, at Kew.

PARMELIA (*HYPOTRACHYNA*) *Deightoni* Dodge, sp. nov.

Type: Sierra Leone, top of Sankon Biriwa Mt., 1930 m., ramulicole on bush, F. C. Deighton 3504, at Kew.

Thallus 3×1.3 cm., obscure olivaceo-alutaceus, K evanescenter flavescens, lobis imbricatis, 3×2 mm., marginibus crenatis, sinibus acutis, eciliatus; infra niger, rhizinis tenuibus, 0.3–0.5 mm. longitudine; cortex superior 25μ crassitudine, fastigiatus; stratum algarum coloniis discretis *Trebouxiae*, 25μ diametro, cellulis 4–5 μ ; medulla K flavidula, C–, KC–, 40μ crassitudine, hyphis longitudinalibus 6μ diametro, pachydermeis; cortex inferior niger, 16–20 μ crassitudine, pseudo-parenchymaticus ex hyphis longitudinalibus, cellulis pachydermeis, 6μ diametro.

Apothecia 3 mm. diametro, substipitata, margine integro, inflexo, excipulo laevi, eciliata, disco subconcavo, imperforato, rufo; cortex amphithecialis 40–50 μ crassitudine, fastigiatus; stratum algarum 20–25 μ crassitudine, coloniis discretis, cellulis 6–7 μ diametro; medulla subdense contexta; stratum algarum sub parathecio 25 μ crassitudine, subcontinuum; parathecium 30 μ crassitudine, fastigiatum, gelifactum; hypothecium 15 μ crassitudine, hyphis tenuibus periclinalibus, compacte intertextis, inferne laxius; thecium 80–85 μ altitudine; paraphyses tenues, septatae, superne moniliformes, apicibus clavatis; asci clavati, $80 \times 16 \mu$, pachydermei, apicibus incrassatis; ascosporae octonae, ellipsoideae, $10-13 \times 5-6 \mu$, episporio teuni.

Thallus 3×1.3 cm., wrapped around twig, deep olive buff, K yellow, fading, C and KC bleaching to white, lobes rounded, 2 mm. wide, 3 mm. long, margin crenate with acute sinuses, eciliate, center sometimes minutely lobulate from injury to the upper surface; underside black, rhizinose to the margin, rhizinae slender, 0.3–0.5 mm. long; upper cortex 25μ thick, fastigate above from dichotomously branched hyphae, the upper 10–12 μ heavily nubilated with brownish granules; algal layer of discrete colonies of *Trebouxia*, 25μ in diameter, cells 4–5 μ ; medulla K very faint yellow, C–, KC–, 40μ thick, of closely woven longitudinal hyphae 6μ in diameter, lumina 1μ ; lower cortex black, 16–20 μ thick, of pseudo-parenchyma from longitudinal hyphae, cells 6μ in diameter with thick, dark brown walls.

Apothecia 3 mm. in diameter, very short stipitate, margin entire, inrolled, exciple smooth, eciliate, disc slightly concave, imperforate, bay; amphithecial cortex 40–45 μ thick, fastigate, outer 15 μ dark brown; algal layer 20–25 μ thick, of discrete colonies, cells 6–7 μ in diameter; medulla moderately closely woven with some small air spaces; algal layer under the parathecium 25 μ thick in a nearly continuous layer; parathecium 30 μ thick, gelified, fastigate but hyphae somewhat irregularly arranged; hypothecium 15 μ thick, of slender, periclinal hyphae, very

closely woven above, looser below; thecium 80–85 μ tall; paraphyses slender, septate, simple or sparingly dichotomous, branches moniliform, tips clavate, ending about 2 μ below the surface of the brownish epithelial gel; asci clavate, 80 \times 16 μ , wall moderately thick, tips thicker; ascospores ellipsoidal, 10–13 \times 5–6 μ , with a thin epispore.

SIERRA LEONE: summit of Sankon Biriwa Mt., 1930 m., ramulicole on bush, F. C. Deighton 3504, at Kew.

PARMELIA (HYPOTRACHYNA) SCOTTII Vainio, Hedwigia 3: (40). 1898.

Type: Uganda, Mt. Ruwenzori, G. F. Scott-Elliott 12.

Thallus probably 10–12 cm. in diameter, deep olive buff, peripheral lobes about 30 mm. long, 3–4 mm. wide, convex, repeatedly but irregularly dichotomous, sides sometimes lobulate, terminal lobes about 2 mm. wide, tips rounded, crenate, surface subnitid, somewhat rimulose toward the center, opaque, with abundant apothecia; underside black, rhizinoze to the margin; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 6 μ in diameter, rather thinwalled, nubilated with brownish granules; algal layer 15–20 μ thick, nearly continuous, cells 6 μ in diameter; medulla K yellow in a narrow zone next the algal layer, the rest negative, C–, KC–, 95 μ thick, of closely woven longitudinal hyphae 3 μ in diameter, very thickwalled, the upper 55 μ very heavily nubilated with grayish granules; lower cortex 12 μ thick, of dark brown fastigiate pseudoparenchyma, cells 5–6 μ in diameter.

Apothecia abundant in the center of the thallus, sessile, 3–4 mm. in diameter, margin entire becoming subcrenulate in age, exciple smooth, disc imperforate, slightly rugulose, chestnut, flattened but remaining concave; amphithecial cortex 40 μ thick, gelified, fastigiate, protoplasts about 1.5 μ in diameter, submoniliform but not clearly septate; algal layer nearly absent, represented by an occasional colony 30 μ in diameter, just within the medulla; medulla closely woven; algal layer under the parathecium 30 μ thick, nearly continuous, cells closely packed; parathecium 50–65 μ thick, of fastigiate pseudoparenchyma, protoplasts 3 μ in diameter, very deeply staining; hypothecium 30 μ thick, of moderately closely woven slender, periclinal hyphae, much less deeply staining; thecium 65 μ tall; paraphyses septate, about 2 μ in diameter, tips clavate, 5 μ in diameter, reaching the surface of the brownish epithelial gel; asci clavate, about 30 \times 12 μ , wall moderately thick, tips somewhat thicker; ascospores short ellipsoid, about 8 \times 5.5 μ (immature). Dümmer 3397a has maturer ascospores 13.5–16 \times 8 μ .

Only the upper part of the medulla of our specimens is K yellow. Perhaps if Vainio shaved off only the cortex and algal layer in exposing the medulla for his test, he would not have noted that the lower part is K–. Probably it is the grayish granules confined to the upper part which react with K.

EAST TROPICAL AFRICA: between 2° and 7° S., J. Hannington, det. P. tiliacea by Müller Argau, at Kew.

UGANDA: Mt. Elgon, summit of Jackson's Peak, on rocks, 4580 m., R. A. Dümmer 3397a, Dümmer-Maclennan Exp., at Kew.

PARMELIA (HYPOTRACHYNA) LEPTASCEA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:514. 1926.

Type: Tanganyika?, Lake Victoria, corticole, *Schroeder* 319.

Thallus about 6 cm. long, 2.2 cm. wide, surrounding small branches, deep olive buff, lobes growing lengthwise of the twig, about 20 mm. long, 5 mm. wide, irregularly subpinnatifid, with lobes about 3 mm. long and wide, with rounded sinuses, lobes growing around the twig 20 mm. wide, 8–10 mm. long, deeply crenate with rounded sinuses, surface smooth, minutely white reticulate but not cracked; underside black, densely rhizinose in the center, less so on the lobes, rhizinae 1–2 mm. long, much branched, those just back of the margin mostly simple and simulating marginal cilia, tips somewhat swollen and bulb-like when in contact with the substrate; upper cortex 13 μ thick, of fastigate pseudoparenchyma, cells 4 μ in diameter; algal layer 20–25 μ thick, nearly continuous, cells 6–7 μ in diameter, interrupted at more or less regular intervals corresponding to the white reticulations of the surface of the thallus; medulla K–, C–, KC– (variously lutescent and more or less rufescent in original description), 80–85 μ thick, of thickwalled, closely woven longitudinal hyphae 5–6 μ in diameter, lumen 1 μ , with large air spaces just under the algal layer and tearing on sectioning, very heavily nubilated with grayish granules, somewhat looser with air spaces next the lower cortex; lower cortex 16 μ thick, black, of fastigate pseudoparenchyma, cells subspherical, about 4 μ in diameter; rhizinae 75 μ in diameter, formed by downward branches of medullary hyphae, corticated from cells of the lower cortex.

Apothecia abundant, often crowded, pedicellate and deeply urceolate at first, finally nearly plane, 4–6 (–14) mm. in diameter, margin entire, slightly inflexed, exciple smooth, subnitid, disc chestnut, imperforate; amphithecial cortex 16 μ thick at the margin, expanding to 35 μ below, similar in structure to the thalline cortex, heavily nubilated throughout at the margin, less so and only in the outer half below; algal layer 25–30 μ thick, of close discrete colonies; algal layer under the parathecium 25–30 μ thick, nearly continuous with occasional algal cells from either layer penetrating the medulla; parathecium 20–25 μ thick, of fastigate pseudoparenchyma; hypothecium 16–18 μ thick, of slender, thinwalled hyphae, more deeply staining next the parathecium; thecium 65 μ tall; paraphyses 2–2.5 μ in diameter unbranched, tips clavate, about 3.8 μ in diameter, ending in the dark brown epithelial gel about 7 μ thick; asci ellipsoidal, 42–45 \times 16–17 μ , tip thickened when young, 9-spored; ascospores distichous, broadly ellipsoid, 10 \times 6.5 μ , with a thick episore.

Spermogonia immersed, 170 μ in diameter, wall darkened about the ostiole, otherwise hyaline; spermatia bacilliform, 5–6 \times 0.6 μ fide Steiner & Zahlbruckner.

Although the chemical reactions are completely negative and the dimensions are at about the lower limits of those given in the original description, our Nyasaland specimens seem to belong here. *Lythgoe* L5 and *Turrall* 70 have the medulla K yellow, slowly orange, KC yellow then orange, but otherwise agree.

ETHIOPIA: Chokke Mts. 10° 40' N., 37° 45' E., wood behind Camp I, 3220 m., on deeply shaded bush, *J. N. Lythgoe* L5, C.B.E.E., at Kew.

UGANDA: Kigezi, Mafuga, 2250 m., corticole, *I. R. Dale* p. p. min.; Kipango, on bark of *Albizia Brownei*, *R. A. Dümmer* 602 p. p. min., both at Kew.

TANGANYIKA: Kilimanjaro, R. G. Turrall 70, growing over mosses, ex herb. E. African Agr. Res. Inst. Amani, at Kew.

NYASALAND: Nchisi Mt., 1600 m., on living *Loranthus* sp., L. J. Brass 16995; Cholo Mt., 1200 m., corticole in rain forest, L. J. Brass 17730, 17746, 17748, 17788, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (HYPOTRACHYNA) ORCHIDOPHILA Dodge, Ann. Missouri Bot. Gard. 40:374. 1953.

Type: Uganda, Western Province, Toro District, Nyinabitsa, in ridge forest, 2500 m., on roots of *Tridactyle bicaudata* (Lindl.) Schltr., H. A. Omasin 1184, at Kew.

Thallus 3–4 cm. in diameter, 95–100 μ thick, deep olive buff, K very slowly pale yellow, lobes rounded, crenate, sinuses excised, ultimate lobules up to 3 mm. wide, margins ciliate, cilia 0.5 mm. long, surface smooth, slightly impressed, white reticulate, slightly rimulose; underside black with chestnut margins, rhizinae covering the whole underside, black with 1–2 dichotomous branches, about 1 mm. long in the center of the thallus, shorter toward the margin; upper cortex 12 μ thick, of thinwalled fastigate pseudoparenchyma, cells 5 μ in diameter, nubilated with brownish granules; algal layer 16–20 μ thick, cells 5 μ in diameter; medulla K yellow then orange red, C–, KC–, 55 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with white to pale buff granules, becoming orange in moribund thalli; lower cortex black, 12 μ thick, pseudoparenchymatous, cells 4 μ in diameter; rhizinae 20 μ in diameter. Apothecia not seen.

KENYA: Eldoret, 2220 m., on uliowa tree near Lamok river, growing over roots of *Polystachya spatella*, G. R. Williams 90A, at Kew.

TANGANYIKA: Ufipa, Chapota, growing over roots of *Polystachya* on *Brachystegia*, A. A. Bullock 2035; Nkundi Chapota, 2255 m., on roots of *Diaphoranthus pulchella* on branch of *Acacia*, 6 m. up, in dense shade, A. A. Bullock 1962 p. p. min.; both International Red Locust Control Service, at Kew.

UGANDA: Western Province, Toro District, Nyinabitsa, in ridge forest, 2500 m., on roots of *Tridactyle bicaudata* (Lindl.) Schltr. H. A. Omasin 1184, at Kew.

PARMELIA (HYPOTRACHYNA) SUFFIXA Stirton, Scottish Nat. 4:299. 1877-8.

Type: Cape of Good Hope, near Knysna, corticole, J. B. Nobel.

Thallus at least 6 cm. in diameter, marginal lobes deep olive buff, shading to chamois in the center, lower branches irregularly dichotomous, up to 1.5 mm. wide below, narrower above, upper branches subpinnate, sinuses excised or at least rounded, ultimate lobules truncate or retuse, 0.5 mm. wide, not truly ciliate but appearing so from the rhizinae near the margin bending outward; underside black, rhizinoae to the margins, rhizinae slender, short, simple or branched, upper cortex 12–13 μ thick, fastigate, cells rounded, 4–5 μ in diameter, very thickwalled, conglutinate; algal layer 20 μ thick, of solitary cells 9 μ in diameter and small colonies of *Trebouxia*, cells about 6 μ in diameter, between more or less vertical medullary hyphae in a continuous layer, with occasional cells deeper in the medulla; medulla K–, C deep pink, KC pink, 50 μ thick, of moderately closely woven longitudinal hyphae 3–4 μ in diameter, with occasional nearly vertical hyphae; lower cortex black, 10–13 μ thick, pseudoparenchymatous from longitudinal hyphae; rhizinae 30 μ in diameter.

Apothecia up to 11 mm. in diameter, cupulate at first, becoming nearly flat, sometimes cracking radially at maturity, margin crenulate, slightly inflexed at first, exciple smooth, disc chestnut, imperforate; amphithecial cortex $55\ \mu$ thick, of fastigiate pseudoparenchyma, cells rather thinwalled, rounded, about $10\ \mu$ in diameter, heavily nubilated with brownish granules; algal layer of discrete colonies about $30\ \mu$ in diameter; medulla very loosely woven; algal layer under the parathecium $40\ \mu$ thick, continuous; parathecium $20\ \mu$ thick, pseudoparenchymatous, of thickwalled periclinal hyphae, protoplasts deeply staining; hypothecium $15\ \mu$ thick, of slender, periclinal hyphae, scarcely staining; thecium $80\ \mu$ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, ending $5\ \mu$ below the surface of the pale brown epithelial gel; asci cylindric, $55 \times 10\ \mu$, wall thick, tip thicker, 8-spored; ascospores ellipsoidal, $13-14 \times 6-8\ \mu$.

Burcbell 230, sterile, growing tangled with *P. Sanctae-Helenae* and glued tightly to the herbarium sheet, seems to be this species.

ST. HELENA: *Burcbell* 230, at Kew.

SOUTH AFRICA: without locality, *Drège*, det. *P. sinuosa* v. *scortea* Laur. ex herb. Sonder in Tuckerman Herb. at Farlow Herb.; Swellendam, collector not given, possibly *Drège*, no. 94, originally det. "*Parmelia an crenulata mihi in Humb.*" in W. J. Hooker's handwriting, herb. Hookerianum, at Kew.

SUBG. AMPHIGYMNIA (Vainio) Dodge, comb. nov.

Parmelia sect. *Amphigymnia* Vainio, Etude Lich. Brésil 1:28. 1890.

Parmelia subg. *Euparmelia* sect. *Amphigymnia* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. 1^e:213. 1907.

Parmotrema Mass., Atti I. R. Ist. Veneto Sci. Lett. Arti III. 5:248. 1860. The type of *Parmotrema* is *Parmelia perforata* (Wulf.) Ach.

Type: not designated.

Thallus monophyllous, lobes rounded, if long, relatively broad, margins entire or crenate, usually ascending, often lobulate or ciliate or both, nude below, usually in a broad zone more than 3 mm. wide; underside black in the center, margins usually some shade of brown; rhizinae stout, usually short, sparse when forming holdfasts, longer, tips acute resembling cilia when not making contact with the substrate; medulla white, rarely citrine in sect. *Subflavescentes*. Apothecia substipitate to stipitate, usually large; disc often perforate; parathecium usually of fastigiate hyphae or pseudoparenchyma but of periclinal hyphae or pseudoparenchyma in 12 African species, the lower part fastigiate, the upper part periclinal in 2 African species; asci usually thinwalled with only tips thickened when young or with wall up to $2.5\ \mu$ thick, but walls $3\ \mu$ thick or more with ascospores usually with thick episporous in 13 African species. Spermatogonia of the usual type immersed in the thallus, but confined to bullate prominences resembling pseudostromata of *Pertusaria* in 2 African species.

This subgenus is usually divided into two sections: the *Subflavescentes* with the upper surface yellow green corresponding to sect. *Xanthoparmelia* in subg. *Euparmelia*, and the *Subglauescentes* with the upper surface glaucous to gray, corresponding to *Hypotrachyna* of *Euparmelia*. In general this separation presents no problem, but in working with specimens long preserved in herbaria, one encounters the same problem as in separating *Xanthoparmelia* from *Hypotrachyna*, see p. 52.

1. Thallus yellow stramineous..... Sect. SUBFLAVESCENTES 2
1. Thallus ashy glaucous to almost white, at least not yellowish, sometimes buff in old specimens..... Sect. SUBGLAUCESCENTES 14
2. Medulla citrine..... 3
2. Medulla white or color not recorded and presumed white..... 4
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5. Surface with pseudocyphellae growing out as capitate soredia; margins nodular with soralia soon confluent into a band of coarse granular soredia; apothecia up to 3.5 mm. in diameter, exciple smooth, becoming pseudocyphellate; ascospores $10-11 \times 6-7 \mu$; medulla K-, C pink above, KC yellow; corticole; Ethiopia..... *P. ethiopica* Dodge
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37. Ascospores $16-19 \times 11 \mu$; apothecia 14-15 mm. in diameter, exciple reticulate rugulose to subscrobiculate, ciliate; medulla K-, C-, KC-; corticole; Nigeria.....*P. nigeriensis* Dodge
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52. Thallus rugose in center, margins smooth; apothecia up to 6 mm. in diameter, exciple smooth, radially rugose below; ascospores $9-10 \times 4-5 \mu$; medulla K-, C-, KC-; on decorticate twigs; Madagascar..... *P. ramulicola* Dodge
53. Ascospores $19 \times 11 \mu$; N. Rhodesia..... *P. Menybarti* Steiner
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55. Ascospores $11-15 \times 7-9 \mu$; apothecia 2-4 mm. in diameter, exciple smooth; medulla K-, C red; spermatophores $50-90 \times 2 \mu$, septate, branched; spermatia $10-12 \times 1 \mu$; Kenya..... *P. modesta* Hue
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56. Apothecia imperforate, exciple smooth; disc imperforate; ascospores $15-22 \times 9-11 \mu$;
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PARMELIA (AMPHIGYMNIA) paxinoides Dodge, sp. nov.

Type: Madagascar, Imerina, Andrangolaoka, corticole, J. M. Hildebrandt, Nov. 1880, sub *P. crinita* ex herb. Sbarbaro at Farlow Herb.

Thallus 5 cm. diametro, fragillima, cinnamomeo-alutaceus, roseo-alutaceusve, K-, lobis periphericis rotundatis, 20×15 mm., marginibus undulatis, crispatis, dense ciliatis, ciliis 4 mm. longitudine, subflexuosis, lobis centralibus lobulatis, lobulis 1×1 mm., ciliatis; superficies centro scrobiculata, marginibus impressa, apaca; infra niger, marginibus castaneo-brunneis, rhizinis nigris, in catervis parvis, 2-3 mm. longitudine, in catervis majoribus brevibus, hapteron commune 0.3 mm. diametro formantibus; cortex superior 10-12 μ crassitudine, fastigiatus, cellulis $10-12 \times 6-7 \mu$, luminibus 1-2 μ diametro, granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 5-6 μ diametro; medulla citrina, K-, C viridi-flava, KC obscurior, 60 μ crassitudine, hyphis verticalibus laxae intertextis, 2-3 μ diametro, compactionibus et magis longitudinalibus sub strato algarum et super corticem inferiorem; cortex inferior 7-10 μ crassitudine, hyphis longitudinalibus, cellulis isodiametricis, 6-7 μ diametro.

Apothecia stipitata, cupuliformia, 10 mm., diametro, stipite 5 mm. altitudine, 3 mm. diametro, longitudinaliter subrugoso, rimoso-areolato, marginibus lobulatis, excipulo alte scrobiculato, disco castaneo; cortex amphithecialis 30 μ crassitudine, fastigiatus, hyphis 4-5 μ diametro, luminibus 1 μ , granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, continuum, nubilatum; medulla compacta arachnoideae; stratum algarum sub parathecio 30 μ , crassitudine, continuum; parathecium 50 μ crassitudine, pseudoparenchymatice fastigiatum, superne cellulis subpericlinalibus; hypothecium 25 μ crassitudine, hyphis tenuibus, periclinalibus, dense intertextis, subgelifacticis; thecium 105 μ altitudine; paraphyses tenues, ramosae, ramis ultimis submoniliformibus, apicibus clavatis; asci stipitati, ventre ellipsoideo, $30 \times 16 \mu$, stipite 35 μ longitudine, pachydermei; ascosporae quinae senaeve, $30 \times 15-16 \mu$, episporio 3 μ crassitudine.

Spermogonia submarginalia, 100 μ altitudine, 130 μ diametro, oblate sphaeroidae; fulcrum 7-8 μ crassitudine, pseudoparenchymaticum; cellulis ex hyphis periclinalibus obscure brunneis; spermatophorae $55 \times 1 \mu$, septatae; spermatia lateralia, recta $4 \times 0.7 \mu$.

Thallus 5 cm. in diameter, probably larger, very fragile, cinnamon buff to pinkish buff (1957), K-, C bleached to white, peripheral lobes rounded, 20 mm. long, 15 mm. wide, margins undulate, crisped, quite closely ciliate, cilia 4 mm. long, flexuous, central lobes lobulate, lobules about 1 mm. wide and long, equally ciliate; upper surface impressed near the margins, shallowly scrobiculate toward the center, not or only slightly rimulose, opaque; underside black, shading to chestnut brown at the margins, shining, smooth to minutely rugulose; rhizinae black, in small groups 2-3 mm. long resembling cilia, if not making contact with the bark, others in larger groups stout, short ending in a common disciform

holdfast 0.3 mm. in diameter; upper cortex 10–12 μ thick, fastigate, of cylindric cells 10–12 \times 6–7 μ , lumina 1–2 μ in diameter, heavily nubilated with brownish granules; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla citron yellow (pigment soluble in alcohol), K– or slightly deeper yellow, C greenish yellow, KC deeper greenish yellow, 60 μ thick, very loosely woven, more closely woven and hyphae more longitudinal next the algal layer and the lower cortex, but of predominantly vertical hyphae, 2–3 μ in diameter, not nubilated; lower cortex near tips of lobes 7–10 μ thick, pseudoparenchymatous from longitudinal hyphae, cells 5–6 μ in diameter with moderately thick, dark brown walls, nearer the center of the thallus 20 μ thick, highly gelified, appearing amorphous in the inner half, outer half of cylindric cells 6 \times 4 μ , heavily nubilated with brownish granules, outer 4 μ hyaline and amorphous.

Apothecia cupulate, stipitate, 10 mm. in diameter, stipe 5 mm. tall, 3 mm. in diameter, slightly longitudinally rugose, cortex areolate, yellow medulla showing from the cracks, margins lobulate at first, lobules mostly broken off in mature apothecium; exciple very deeply reticulate scrobiculate, tops of the larger ridges cracking and exposing the yellow medulla; disc burnt sienna to chestnut, very concave, imperforate; amphithecial cortex 30 μ thick, fastigate, hyphae 4–5 μ in diameter, lumina about 1 μ , nubilated with brownish granules; algal layer 15 μ thick, continuous, heavily nubilated; medulla varying from closely woven to arachnoid; algal layer under the parathecium 30 μ thick, continuous, heavily nubilated; parathecium 50 μ thick, of thickwalled pseudoparenchyma, fastigate below, cells irregularly arranged in the middle and almost periclinal above; hypothecium 25 μ thick, of slender periclinal, closely woven hyphae, somewhat gelified; thecium 105 μ tall; paraphyses slender, sparingly septate, several times dichotomous in the lower and upper thirds, ultimate branches slightly moniliform, tips clavate in the brownish epithelial gel; asci 5–6-spored, stipe 35 μ long, venter ellipsoid, 30 \times 16 μ , walls 6–7 μ thick when young, thinning as the ascospores mature; ascospores oblong-ellipsoid, 30 \times 13–16 μ , epispore 3 μ thick.

Spermogonia submarginal, oblate spheroidal, 100 μ tall, 130 μ in diameter; wall 7–8 μ thick, pseudoparenchymatous from dark brown periclinal hyphae, neck about 60 μ , outside diameter; spermatiphores septate, 65 \times 1 μ ; spermatia lateral, straight, about 4 \times 0.7 μ .

MADAGASCAR: Imerina, Andrangolaoka, corticole, J. M. Hildebrandt, Nov. 1880, sub *P. crinita* ex herb. Sbarbaro at Farlow Herb.

PARMELIA (AMPHIGYMNIA) neghelliensis (Cengia Sambo) Dodge, comb. nov.

Parmelia soledica v. *neghelliensis* Cengia Sambo, R. Accad. Ital. Miss. Biol. Paese Borana, Rec. Bot. Lich. 380. 1939.

Type: Ethiopia, Borana, Neghelli, on *Juniperus*, *Cusodontis*.

Thallus at least 9 cm. in diameter, probably larger, deep olive buff to olive buff, peripheral lobes at least 10 mm. long, 3–5 mm. wide, irregularly dichotomous and subpinnate, very imbricate, sinuses rounded, margins crenate, eciliate, reticulate simulose, surface smooth or nearly so; central lobes much smaller, surface and

margins nodular, nodules 0.2–0.3 mm. in diameter, mostly subspheric, some more elongate like very coarse isidia, usually remaining corticate, a few with eroded cortex resemble small capitate soredia but not truly so; underside black to the margin, opaque, reticulate rugulose, rhizinae not abundant, stout, short, ending in disciform holdfasts; upper cortex 30 μ thick, of thinwalled, fastigate pseudoparenchyma, cells about 4 μ in diameter, somewhat nubilated by pale brownish granules in the upper half; algal layer about 40 μ thick, continuous, cells 7–8 μ in diameter, a few cells deeper in the medulla; medulla K–, C–, KC–, 105 μ thick, of moderately closely woven predominantly oblique and longitudinal hyphae, slightly nubilated with hyaline granules; lower cortex 16–19 μ thick, of fastigate pseudoparenchyma, cells 6–7 μ in diameter with moderately thick dark brown walls.

The nodules are formed by a vertical strand of medullary hyphae about 30 μ in diameter, pushing upward and carrying the algal layer and upper cortex with it; the upper cortex becomes thinner, about 16 μ thick and finally erodes at the top of the nodule, exposing the algal layer, but the algae are not formed into typical soredia, although there is a tendency for the algal cells to be grouped in colonies of varying size. This species does not seem to be closely related to *P. soredica* from western North America and even Cengia Sambo thought it might be a distinct species.

TANGANYIKA: Usambara, Muandara forest, corticole, *C. Holst* 2662 p. p., rather fragmentary, at Kew.

PARMELIA (AMPHIGYMNIA) *albaniensis* Dodge, sp. nov.

Type: Cape of Good Hope, forests of Albany, corticole, *Zeyher* 3, in Taylor Herb. sub "allied to *P. rugosa* T." det. *P. caperata* by Tuckerman, at Farlow Herb.

Thallus ad 6 cm. diametro, inter citrino-ravus et obscure olivaceo-alutaceus, lobis periphericis 10×8 –10 mm., marginibus crenatis, sinibus acutis, apicibus subtruncatis, tenuiter nigro-marginatis, eciliatus, superficies transversim rugosa, soralia capitata, 0.2 mm. diametro, sorediis granulosis; infra niger, opacus, rhizinis paucis, ca. 0.5 mm. longitudine; cortex superior 30 μ crassitudine, fastigiatus, hyphis 3–4 μ diametro, septatis, cellulis superne isodiametricis; stratum algarum 25 μ crassitudine, coloniis densis *Trebouxiae*, cellulis 6–11 μ diametro; medulla K–, C–, KC–, 160 μ crassitudine, zona superior 15 μ crassitudine hyphis verticalibus 3 μ diametro, laxissimis, zona media ca. 100 μ crassitudine, hyphis longitudinalibus laxè intertextis, granulis griseis nubilatis, et zona inferiori 45 μ crassitudine hyphis longitudinalibus compactis non nubilatis; cortex inferior 20 μ crassitudine, niger, pseudoparenchymatice fastigiatus.

Apothecia ad 10 mm. diametro, margine crenato juventute inflexo, soredioso, excipulo rugoso-scribiculato, disco rufo-brunneo; cortex amphithecialis 45 μ crassitudine, pseudoparenchymatice fastigiatus, stratum algarum 30 μ crassitudine, coloniis discretis, granulis brunneis nubilatis; medulla hyphis compacte intertextis; stratum algarum sub parathecio 30 μ crassitudine, subcontinuum; parathecium 30 μ crassitudine, hyphis periclinalibus pseudoparenchymaticum, lumina 3–4 \times 2 μ ; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus, laxè intertextis; thecium 80 μ altitudine; paraphyses tenues, septatae, bis terve dichotomis, apicibus

subincrassatis; asci clavati, $65 \times 15 \mu$, pachydermei; ascosporae octonae ellipsoideae, $13 \times 6.5 \mu$, episporio crasso.

Thallus of several fragments with cortex and algal layer rubbed off in spots from rough handling, at least 6 cm. in diameter, probably larger, between citrine drab and dark olive buff, shading toward vinaceous buff on some fragments (1957), one peripheral lobe at least 10 mm. long, 8–10 mm. wide, sinuses rounded, closely appressed to the bark, margin deeply crenate with acute sinuses, tips nearly truncate, smooth, very narrowly black margined, eciliate, surface transversely rugose toward the margin, more irregular toward the center with capitate soralia, 0.2 mm. in diameter, soredia granular; underside black, opaque to the margins, rhizinae few, stout, about 0.5 mm. long, mostly torn away, carrying a small portion of the lower cortex; upper cortex 30μ thick, fastigate, hyphae $3\text{--}4 \mu$ in diameter, thin-walled, once dichotomous just above the algal layer and again about 15μ from the surface, ultimate branches conglutinate and gelified, but apparently septate into isodiametric cells; algal layer 25μ thick of closely packed colonies of *Trebouxia*, cells $6\text{--}11 \mu$ in diameter; medulla K-, C-, KC- or faint yellow, 160μ thick, with an upper zone 15μ thick with large air spaces and vertical hyphae, 3μ in diameter, which grow up between the algal colonies to form the upper cortex, not nubilated, a middle zone about 100μ thick, of loosely woven, predominantly longitudinal hyphae, the interstices filled with grayish granules and a lower zone 45μ thick, of closely woven longitudinal hyphae, not nubilated; lower cortex 20μ thick, black, of fastigate pseudoparenchyma, easily tearing from the medulla on sectioning.

Apothecia up to 10 mm. in diameter, margin deeply crenate and inflexed when young, forming a narrow continuous band of soredia, exciple rugose scrobiculate, disc auburn; amphithecial cortex 45μ thick, of fastigate pseudoparenchyma; algal layer up to 30μ thick, of discrete colonies, heavily nubilated with brownish granules, dying in places and medullary hyphae making contact with the cortex; medulla quite closely woven, heavily but irregularly nubilated; algal layer under the parathecium 30μ thick, colonies nearly continuous; parathecium 30μ thick, of gelified pseudoparenchyma from periclinal hyphae, lumina $3\text{--}4 \times 2 \mu$; hypothecium 25μ thick, of slender loosely woven, periclinal hyphae; thecium 80μ tall; paraphyses slender, septate, twice to thrice dichotomous above the asci, tips slightly clavate, reaching the surface of the brownish epithelial gel; asci clavate, 8-spored, $65 \times 15 \mu$, wall 3μ thick, tips somewhat thicker; ascospores short ellipsoid, $13 \times 6.5 \mu$, with a moderately thick episore.

Before the type specimen was collected, patches of the thecium had been eaten. Where only the parathecium was exposed, there was no regeneration, but where the algal layer underneath was exposed, the algae proliferated to form granular soredia about 30μ in diameter.

CAPE OF GOOD HOPE: forests of Albany, corticole, Zeyher 3, type, in Taylor Herb. sub "allied to *P. rugosa* T." det. *P. caperata* by Tuckerman in Taylor Herb. at Farlow Herb.: without locality or collector but probably duplicate of the above, Herb. Hookerianum at Kew.

NATAL: Drakenberg, Feilden, det. *P. caperata* by Müller Argau, at Kew (2 collections).

PARMELIA (AMPHIGYMNIA) *ethiopica* Dodge, nom. nov.

Parmelia cristifera v. *abissinica* Cengia Sambo, Nuovo Giorn. Bot. Ital. 46:445. 1939, non *P. abessinica* Nyl. in Krmph., 1877.

Type: Ethiopia, Addis Ababa, corticole, *Senni 92*.

Thallus 10 cm. or more in diameter in confluent patches, green when fresh, drying to ecru-olive and dark olive buff, K-, lobes imbricate, marginal lobes up to 10 mm. long and wide, margins rounded, shallowly crenate to crenulate, central lobes nodular soraliate, soon confluent into a band of white, coarse granular soredia; upper surface of marginal lobes slightly rugose and pseudocyphellate, central lobes more deeply rugose to somewhat scrobiculate with pseudocyphellae growing out to form nodular soralia up to 0.5 mm. in diameter; eciliate; underside black, minutely reticulate rugulose shading to russet at the smoother margins; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, hyphae about 4 μ in diameter, cells longer than wide, upper third brownish; algal layer about 15 μ thick, of close, discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K-, C pink in upper portion, negative below, KC yellow, 130 μ thick, upper half of moderately dense vertical hyphae interlaced with longitudinal hyphae, densely nubilated with grayish granules, lower half of predominantly longitudinal hyphae, very closely woven, 3–4 μ in diameter; lower cortex black, 13–16 μ thick, pseudoparenchymatous from longitudinal hyphae.

Apothecia up to 3.5 mm. in diameter, sessile, margins entire at first becoming sorediate, exciple smooth becoming pseudocyphellate, disc deeply urceolate becoming nearly plane, orange rufous or darker; amphithecial cortex 30 μ thick, similar to the thalline cortex; algal layer 20 μ thick, continuous but cells not closely packed, 9–10 μ in diameter; medulla very loosely woven, not nubilated; algal layer under the parathecium 35 μ thick, continuous, cells closely packed; parathecium 20 μ thick, of very thickwalled, interwoven periclinal and oblique hyphae, rather closely septate, not sharply differentiated from the hypothecium, scarcely staining; hypothecium 20 μ thick, of thinner-walled periclinal, deeply staining hyphae, less closely septate; thecium 65 μ tall; paraphyses thickwalled, closely septate, tip clavate to subspheric, 3 μ in diameter, ending in the pale brownish epithelial gel; asci 35 \times 10 μ , clavate becoming ellipsoidal, 8-spored, 50 \times 20 μ , walls 3 μ thick, tips 6 μ ; ascospores subdistichous, broadly ellipsoidal, 10–11 \times 6–7 μ with a thick episore.

All the characters reported for *P. cristifera* v. *abissinica* agree with our material and none are even remotely related to *P. cristifera* Tayl. from India, (see p. 178), which apparently Cengia Sambo had not seen. Since there is already a *P. abessinica* Nyl. in Krmph. it seems unwise to use Cengia Sambo's varietal name which differs in spelling by a single letter. As her material is sterile, the description of the apothecia is based on *Gillett 5432*. *Gillett 4707* is young with beginnings of pseudocyphellae and apothecia up to 1 mm. in diameter. This species seems related to *P. somaliensis* from which it differs in its pseudocyphellae and marginal soredia.

ETHIOPIA: Luka, 9° 25' N., 41° 40' E., 2415 m., on *Juniperus procera* in regenerating forest, *J. B. Gillett 5432*, Abyssinia-Somaliland Boundary Commission, at Kew.

SOMALILAND: ridge south east of Andoba, 1740 m., 9° 59' N., 43° E., on *Euphorbia* trunk, *J. B. Gillett 4607*, Abyssinia-Somaliland Boundary Commission, at Kew.

KENYA: Eldoret on Lamok River, 2220 m., growing over roots of *Polystachya spatella* on uliowa tree, G. R. Williams 90A p. p. min. at Kew; east side of Mt. Elgon, 2575 m., corticole, A. Burnet L16a, L25a; Kiambu District, Limuru, 2130 m., A. Burnet 1, all in Makerere College Herb.

PARMELIA (AMPHIGYMNIA) *Hendrickxii* Dodge, sp. nov.

Type: Congo, Kahusi, growing over mosses, F. L. *Hendrickx* 4307 p. p. min. in E. African Herb.

Thallus ca. 8 cm. diametro, citrino-ravus aut obscure olivaceo-alutaceus, lobis ad 25 mm. latitudine, marginibus rotundatis, subcrenulatis, subcrispatis, aliis lobis capitato-sorediatis, raro confluentur sorediatis, alteris pauci-ciliatis, cilia 2 mm. longitudine; infra niger, rugosus, zona marginali 5–6 mm. latitudine laevi, nitida, roseo-alutacea, rhizinis 2 mm. longitudine; cortex superior 16–17 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro; stratum algarum 16–20 μ crassitudine, continuum, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus laxe intertextis; cortex inferior 10 μ crassitudine, hyphis longitudinalibus, cellulis isodiametricis.

Thallus about 8 cm. in diameter, citrine drab to deep olive buff, lobes up to 25 mm. broad, variously shaped, margins rounded, somewhat crenulate, slightly crisped, surface smooth to slightly rugose toward the center, margins of some lobes small capitate sorediate, rarely confluent, other lobes with very rare cilia 2 mm. long; underside black, rugose with a marginal zone 5–6 mm. wide, smooth shining, shading from sepia to pinkish buff; rhizinae rare, coarse, 2 mm. long; upper cortex 16–17 μ thick, of fastigate pseudoparenchyma, but cells 5–6 μ in diameter somewhat irregularly arranged, lumina 2 μ in diameter; algal layer 16–20 μ thick, continuous, cells 6–7 μ in diameter; medulla K–, C–, KC–, 65 μ thick, of loosely woven, predominantly longitudinal hyphae with some vertical hyphae and moderately large air spaces under the algal layer and narrower ones next the lower cortex; lower cortex 10 μ thick, pseudoparenchymatous from longitudinal hyphae, somewhat irregularly arranged.

CONGO: Kahusi, muscicole, F. L. *Hendrickx* 4307 p. p. min. in E. African Herb.

PARMELIA (AMPHIGYMNIA) *ECAPERATA* Müll. Arg., *Flora* 74:378. 1891.

Type: Nyasaland, along Shire River, between Lake Nyasa and the Zambesi River, on palm trunks, *Kirk*.

Thallus more than 10 cm. in diameter, ivory yellow at the margins to between ecru olive and citrine drab in the center, marginal lobes rounded, 10 mm. long, 5 mm. wide, imbricated, appressed to the bark, margin smooth or occasionally minutely isidiose, sinuses rounded, surface smooth becoming rugulose toward the center which is densely covered with minute isidia, simple or forked at the tips, obscuring the surface of the thallus over large areas; underside black, smooth or nearly so, rhizinae short, stout; upper cortex 15 μ thick, of fastigate, rather thin-walled pseudoparenchyma; algal layer about 40 μ thick, of discrete colonies of *Trebouxia*, cells 6 μ in diameter, densely packed above, less so below, nubilated with brownish granules; medulla K–, C and KC pale pink, 90 μ thick, of closely

woven longitudinal hyphae, heavily nubilated in the upper half with grayish granules; lower cortex 8–10 μ thick, of septate longitudinal hyphae, 4–5 μ in diameter.

Apothecia rare, sessile, about 3 mm. in diameter, margin thick, crenate, densely isidiose but isidia very fragile and mostly broken off, exciple densely isidiose, disc concave, mummy brown; amphithecial cortex 18–20 μ thick, of thickwalled, fastigate pseudoparenchyma, interrupted at the scars of the broken isidia; algal layer 65 μ thick in a nearly continuous layer, cells 6–7 μ in diameter, densely packed next the cortex, more scattered within and some cells scattered deep in the loosely woven medulla; algal layer under the parathecium 55 μ thick, in a nearly continuous layer; parathecium 15–20 μ thick, of fastigate pseudoparenchyma but the cells somewhat irregularly arranged; hypothecium 25 μ thick, of thickwalled periclinal congrutinate hyphae; thecium 60 μ tall; paraphyses twice or thrice dichotomous above the asci, branches moniliform, tips not thickened, reaching the surface of the brownish epithelial gel; asci clavate, $32 \times 13 \mu$, wall 2.5 μ thick, tip thicker, protoplast mamillate, 8-spored; ascospores ellipsoid, $8 \times 5 \mu$ (perhaps still immature), only seen in the asci.

UGANDA: Bunyoro, Busingiro, on bark of old *Jacaranda* tree, I. R. Dale L68c, a fragment, at Kew.

TANGANYIKA: Usambara, Muandara forest, C. Holst 2662, det. *P. tiliacea* f. *scortea* by Müller Argau, at Kew; Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna*, A. A. Bullock 1871 p. p. min., International Red Locust Control Service, at Kew.

PARMELIA (AMPHIGYMNIA) *Steineri* Dodge, nom. nov.

Parmelia caperata v. *isidiophora* Steiner, Sitzungsber. K. Akad. Wiss. Wien, Math. Naturw. Cl. I. 106:215. 1897.

Type: Kenya, Athi Plains, *Liechtenstein*.

Thallus over 12 cm. in diameter, dark olive buff to deep olive buff, lobes rounded, closely appressed, ultimate lobules 3–4 mm. long, 2–3 mm. wide, with minute rounded to excised sinuses; upper surface mostly smooth toward the margins, central portions rugulose and bullate rugose in the depressions, with irregular isidiose areas up to 10 mm. or more in diameter, isidia very slender, from coarsely granular to very short coralloid; underside black, shining shading to buckthorn brown or lighter, rugulose, nude at the margins, central portion nude or with patches of moderately close and short slender rhizinae, with subspheric tips where coming in contact with the substrate; upper cortex 22–25 μ thick, of fastigate pseudoparenchyma, cells thinwalled, 5–6 μ in diameter, somewhat irregularly arranged, very heavily nubilated with greenish brown granules, interrupted by minute cracks 6–7 μ wide extending to the air spaces under the algal layer; algal layer 16–20 μ thick, a nearly continuous layer of colonies of *Trebouxia*, cells 6 μ in diameter; medulla K–, C–, KC–, 125 μ thick, very loosely woven under the algal layer to moderately close below, hyphae predominantly longitudinal but with many oblique and nearly vertical single hyphae in the upper half, about 2 μ in diameter, with scarcely visible lumina; lower cortex black, about 13 μ thick, of two layers of longitudinal, relatively thinwalled hyphae with isodiametric cells, the outer layer more or less collapsed, giving rise to rhizinae about 65 μ in diameter.

Apothecia rather rare, on the older portions of the thallus, 2 mm. in diameter, single or in crowded group of up to 4, deeply urceolate, substipitate; margins densely isidiose, exciple smooth below, disc bay to chestnut; amphithelial cortex 26–32 μ thick, of thinwalled fastigate pseudoparenchyma, interrupted by outgrowth of isidia 30–35 μ in diameter, of closely packed algal cells, corticate with a single layer of cells 5 μ in diameter; algal layer 15–20 μ thick, nearly continuous under the amphithelial cortex, of more discrete colonies where isidia have grown out; medulla very loosely woven, hyphae somewhat brownish; algal layer under the parthecium 30–35 μ thick, continuous, of closely packed cells; parathecium 20 μ thick, of fastigate pseudoparenchyma but cells somewhat irregularly arranged, 4–5 μ in diameter, walls rather thin; hypothecium 13 μ thick, of slender, periclinal hyphae, rather loosely woven; thecium 65 μ tall; paraphyses slender, once or twice dichotomous in the outer half, tips clavate in the very pale brownish epithelial gel; asci ellipsoid, 50 \times 20 μ , with thick walls and tips when young, 8-spored but some spores may abort, leaving only 4–6 mature spores; ascospores ellipsoid, somewhat variable in size, but mostly 17 \times 7–8 μ , epispore about 1 μ thick.

The above description is based largely on *Curtis 743b* as it is better developed and fertile. *Dale L46* p. p. min. seems to belong here although the center is citrine drab shading to dark olive buff and it is sterile, spermogonia abundant on some lobes.

KENYA: Loita Plains, 60 miles southeast of Narok, 1610–2250 m., growing over orchid roots on tree trunk, *Anita Grosvenor Curtis 743b*, in Dodge Herb.

UGANDA: Kigezi, Mafuga, 2415 m., saxicole, *I. R. Dale L46* p. p. min.; Bugishu, Butandiga, 2415 m., on trees, *A. S. Thomas 484* p. p. min.; both at Kew.

NIGERIA: *Barter 503*, Niger Exp. at Kew.

PARMELIA (AMPHIGYMNIA) *nyasensis* Dodge, sp. nov.

Type: Nyasaland, Mt. Nchisi, 1400 m., on dry rocks in *Brachystegia* woodland, *L. J. Brass 16922*, Vernay Nyasaland Exp. in Dodge Herb.

Thallus ca. 8 cm. diametro, flavus, lobis periphericus rotundatis, crispatis, marginibus ciliatis, cilia 1–2 mm. longitudine, tenuia, ramosa, lobis centralibus dentatis isidiosive, isidia tenuia, ad 1 mm. longitudine, coralloidea, fragilia; infra niger, marginibus laevibus, nitidis, umbrinis, rhizinis 2 mm. longitudine, simplicibus; cortex superior 10–12 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3 μ diametro, pachydermeis, strato hypharum periclinalium dein amorpho tectus; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K–, C–, KC–, 50–55 μ crassitudine, hyphis nubilatis dense intertextis, laxioribus sub strato algarum; cortex inferior 8–12 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis parvis brunneis, subgelifactis.

Thallus about 8 cm. in diameter, between colonial buff and primrose yellow, peripheral lobes rounded, coarsely crisped, margins ciliate, cilia 1–2 mm. long, slender, sometimes branched, central lobes dentate to isidiose with isidia mixed with cilia extending in a marginal band up to 4 mm. wide, isidia slender, up to 1 mm. tall, coralloid branched, fragile, breaking off leaving pseudocypelloid scars, surface

of the center of the lobes varying from smooth to impressed punctate and sub-rugose; underside black in the center, rhizinae stout, 2 mm. long, rather dense, unbranched unless the tips in contact with the substrate when they become densely branched and several join to form a common holdfast, marginal lobes shining, nude between Brussels brown and raw umber; upper cortex 10–12 μ thick, of fastigiate pseudoparenchyma, cells thickwalled, about 3 μ in diameter, covered by a layer of periclinal hyphae 4 μ thick, hyphae 2 μ in diameter, which soon gelifies into an amorphous layer; algal layer 15 μ thick, of discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C–, KC–, 50–55 μ thick, of closely woven nubilated hyphae, somewhat looser just under the algal layer; lower cortex 8–12 μ thick, of small celled fastigiate pseudoparenchyma, somewhat gelified and brownish.

In color and habit this species quite closely resembles *P. caperata* v. *madagascariacea* Hue, but differs in microscopic characters and in chemical reactions. Both taxa differ from *P. caperata* in the long-ciliate margins.

CONGO: Kahusi, 2700 m., *F. L. Hendrickx* 4316 p. p. min., in E. African Herb.

NYASALAND: Mt. Nchisi, 1400 m., on dry rocks in *Brachystegia* woodland, L. J. Brass 16022, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (AMPHIGYMNIA) Hansfordi Dodge, sp. nov.

Type: Uganda, Kampala, on bark of *Pithecolobium saman*, C. H. Hansford 1455, at Kew.

Thallus 13 cm. diametro, centro argillaceus vel cinnamomeo-alutaceus, bullato-rugosus, lobulatusque, marginibus obscure olivaceo-alutaceis, lobis rotundatis, 5 mm. latitudine longitudineque, crenatis lobulatisque, lobulis 0.5 mm. latitudine longitudineque; infra cinnamomeo-brunneus, marginibus ochraceo-alutaceis late audis, minute rugosis; cortex superior 20 μ crassitudine, fastigiatus, gelifactus; stratum algarum 15 μ crassitudine, continuum, cellulis 5–6 μ diametro; medulla K–, C–, KC– aut soride rufescens, 200–250 μ crassitudine, hyphis longitudinalibus laxae intertextis, dimidia parte media granulis hyalinis nubilata; cortex inferior 26 μ crassitudine in zonis duabus, interiori 10 μ crassitudine, obscure brunnea, hyphis longitudinalibus, cellulis pachydermeis isodiametricis, zona exteriori 16 μ crassitudine fastigiata, cellulis leptodermeis, pallidioribus.

Apothecia sessilia, 5–6 (–10) mm. diametro, margine integro dein crenulato, excipulo scrobiculato, nitido, disco ferrugineo; cortex amphithecialis 20 μ crassitudine, fastigiatus, gelifactus; stratum algarum 20 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*; medulla hyphis laxae intertextis; stratum algarum subparathecio 25 μ crassitudine, continuum; parathecium 35 μ crassitudine, pseudoparenchymatice fastigiatum, cellulis pachydermeis; hypothecium 35 μ crassitudine, hyphis periclinalibus, tenuibus, leptodermeis laxae intertextis; thecium 55–65 μ altitudine; paraphyses tenues, septatae, super ascos dichotomae, ramis moniliformibus; asci clavati, pachydermei, 35 \times 15 μ ; ascosporae octonae, late ellipsoideae, 7–10 \times 6–7 μ , episporio crasso.

Spermogonia oblate sphaeroideae, 80 μ altitudine, 100 μ diametro, fulcrum obscure brunneum, 6–7 μ crassitudine; spermatophorae 15 μ longitudine, septatae, non bene visae; spermatia bacilliformia, ca. 6 \times 0.6 μ .

Thallus at least 13 cm. in diameter, center clay color to cinnamon buff, shading to deep olive buff at the margins, center bullate rugose and lobulate, smooth at the margins, marginal lobes rounded, about 5 mm. wide and long, crenate to lobulate, lobules 0.5 mm. wide and long; underside cinnamon brown to Prout's brown, marginal lobes ochraceous buff or lighter, minutely rugose, nude; rhizinae torn away in collecting, carrying the lower cortex with them in irregular areas; upper cortex 20 μ thick, fastigiate, gelified; algal layer 15 μ thick, cells 5–6 μ in diameter, probably continuous when young, tending to die in places, leaving lacunae; medulla K–, C–, KC– to slightly sordid rufescent, 200–225 μ thick between the ridges, another 65–100 μ thick under the ridges and bullae, almost devoid of medullary hyphae, of loosely woven, predominantly longitudinal hyphae, very loose in the lower half, with a middle zone about 100 μ thick, very heavily nubilated with minute hyaline crystals and aggregates of crystals in the air spaces of the network, giving a grayish appearance in section; lower cortex 26 μ thick, in two layers, an inner dark brown layer 10 μ thick of pseudoparenchyma from longitudinal hyphae, cells thickwalled, 5 μ in diameter, and an outer layer 16 μ thick, of light brown, thinwalled, fastigiate hyphae.

Apothecia very abundant in the center of the thallus, sessile, 5–6 (–10) mm. in diameter, margin entire at first, becoming crenulate and distorted by mutual pressure of neighboring apothecia, exciple deeply impressed to scrobiculate, shining, cortex disappearing in places, exposing the medulla but not sorediate, disc ferruginous or darker, very concave to nearly plane when old; amphithecial cortex 20 μ thick, fastigiate, gelified; algal layer 20 μ thick, of discrete but nearly continuous colonies of *Trebouxia* with some cells deeper in the loosely woven medulla; algal layer under the parathecium 25 μ thick, continuous; parathecium 35 μ thick of fastigiate pseudoparenchyma, cells very thickwalled, slightly irregularly arranged, tending to become longitudinally oriented with larger, more deeply staining protoplasts above in a layer 20 μ thick and merging into the hypothecium 35 μ thick of strictly periclinal rather thinwalled hyphae, less densely interwoven; thecium 55–65 μ tall; paraphyses slender, septate, dichotomous above the asci, branches somewhat moniliform, reaching the surface of the epithelial gel; asci clavate, 35 \times 15 μ , thickwalled with thicker tips when young, 8-spored; ascospores broadly ellipsoid 7–10 \times 6–7 μ , with a moderately thick epispore.

Spermogonia 80 μ tall, 100 μ in diameter, oblately spheroid with conical neck 20–25 μ tall penetrating through the upper cortex; wall completely dark brown, 6–7 μ thick; spermatophores about 15 μ long, septate, not very clearly seen; spermatia bacilliform, about 6 \times 0.6 μ .

UGANDA: Kampala, on bark of *Pithecolobium saman*, C. H. Hansford 1455, at Kew.

PARMELIA (AMPHIGYMNIA) *Wrightii* Dodge, sp. nov.

Type: Cape of Good Hope, Simon's Bay, saxicole, Charles Wright, U. S. North Pacific Exploring Exp. in Tuckerman Herb. sub *P. conspersa* at Farlow Herb.

Thallus 11 cm. diametro, brunneus, marginibus obscure olivaceo-alutaceus, lobis 25 mm. longitudine, infra 5 mm., superne 10 mm. latitudine, sinuosus, varie lobulatus, apicibus crenatis, sinibus excisis, subimbricatis, lobulis ultimis 2 \times 1

mm., marginibus integris, eciliatis, subnitidis, minute albo-reticulatis sed non rimulosus; infra minute reticulatim rugulosus, nigro-brunneus, rhizinis raris crassis, pallidis; cortex superior $20\ \mu$ crassitudine, fastigiatus, gelifactus, cellulis leptodermeis; stratum algarum $30\ \mu$ crassitudine, coloniis discretis *Trebouxiae*, cellulis $5-6\ \mu$ diametro; medulla K-, C-, KC-, $115-130\ \mu$ crassitudine, hyphis longitudinalibus $3\ \mu$ diametro, laxe intertextis, dichotomis, irregulariter granulis pallide brunneis nubilatis; cortex inferior $10\ \mu$ crassitudine, pseudoparenchymaticus, cellulis $5\ \mu$ diametro leptodermeis.

Apothecia urceolata, 4-5 mm. diametro, margine involuto, minute crenulato, excipulo laevi, nitido dein subreticulatim rimuloso, disco cinnamomeo-rufo vel avellaneo; cortex amphithecialis gelifactus, $30-65\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis $6-7\ \mu$ diametro; stratum algarum $30\ \mu$ crassitudine, coloniis discretis; medulla laxa contexta; stratum algarum sub parathecio $30\ \mu$ crassitudine, continuum; parathecium $25\ \mu$ crassitudine, pseudoparenchymatice fastigiatum; hypothecium $25\ \mu$ crassitudine, hyphis tenuibus periclinalibus dense contextis; thecium $42\ \mu$ altitudine; paraphyses tenues, septatae, superne dichotomae, apicibus clavatis, $6\ \mu$ diametro; asci cylindrico-clavati, $35 \times 9\ \mu$, leptodermei; ascospores octonae, ellipsoideae, $6-8 \times 4-5\ \mu$.

Thallus about 11 cm. in diameter, sayal brown shading to deep olive buff at the margins, main lobes 25 mm. long, 5 mm. wide below expanding to 10 mm. wide near the tips, sinuous to variously lobulate, tips deeply crenate with excised sinuses, somewhat imbricate, central lobes much smaller, dichotomous, ultimate lobules about 2 mm. long, 1 mm. wide, margins smooth, eciliate, surface smooth, somewhat rugose in the center, subnitid, minutely white reticulate, especially on the marginal lobes but not rimulose; underside minutely reticulate rugulose, bister in the center shading to sayal brown at the margins; rhizinae rare in small groups, stout, short, pale to almost hyaline, forming disc holdfasts when in contact with the substrate; upper cortex $20\ \mu$ thick, fastigiate, the upper $12\ \mu$ gelified, of large thinwalled cells, nubilated with brownish granules, the rest hyaline of vertical dichotomous hyphae $3\ \mu$ in diameter; algal layer $30\ \mu$ thick, of discrete, close colonies of *Trebouxia*, cells $5-6\ \mu$ in diameter; medulla K-, C-, KC-, $115-130\ \mu$ thick, of very loosely woven longitudinal hyphae $3\ \mu$ in diameter, dichotomously branched, densely nubilated with pale brown granules in some places not in others; lower cortex $10\ \mu$ thick, pseudoparenchymatous, cells $5\ \mu$ in diameter, with thin brownish walls.

Apothecia urceolate, 4-5 mm. in diameter, margin incurved, minutely crenulate, exciple smooth, shining, then slightly reticulate rimulose; disc cinnamon rufous to hazel; amphithelial cortex gelified, $60-65\ \mu$ thick, of fastigiate pseudoparenchyma, cells $6-7\ \mu$ in diameter, the outer $15\ \mu$ brownish and nubilated; algal layer $30\ \mu$ thick, of closely packed discrete colonies; medulla loosely woven; algal layer under the parathecium $30\ \mu$ thick, continuous; parathecium $25\ \mu$ thick, of fastigiate pseudoparenchyma, lumina $1\ \mu$ in diameter; hypothecium $25\ \mu$ thick, of slender, closely woven, periclinal hyphae; thecium $42\ \mu$ tall; paraphyses slender, septate, dichotomous above, tips clavate, $6\ \mu$ in diameter; asci cylindric clavate, $35 \times 9\ \mu$, walls relatively thin; ascospores ellipsoid, $6-8 \times 4-5\ \mu$.

CAPE OF GOOD HOPE: Simon's Bay, saxicole, *Charles Wright*, U. S. North Pacific Exploring Exp. in Tuckerman Herb. sub *P. conspersa*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) inhaminensis Dodge, sp. nov.

Type: Portuguese East Africa, Inhambane, Inhamine, ramicole on *Coffea*, *D. Luiz Sousa*, Oct. 1937, at Kew.

Thallus 12×3.1 cm., obscure alutaceus, madefactus obscure olivaceo-alutaceus, centro bullato, scrobiculatusve multis cum spermogoniis, lobis periphericis planis, 10×5 mm., marginibus crenatis, apicibus rotundatis; infra niger, marginibus brunneis, nitidis, subrugosis, nudis; cortex superior 16μ crassitudine, fastigiatus, gelifactus; stratum algarum 35μ crassitudine fere continuum, coloniis *Trebouxiae*, cellulis 5μ diametro; medulla alba (cremea quando longe ad aerem exposita), K-, C aurantiaca, KC flavior, 65μ crassitudine, hyphis longitudinalibus, pachydermeis, $4-5 \mu$ diametro, sub strato algarum dense contextis nubilatis, medio laxioribus, inferne densioribus; cortex inferior $20-25 \mu$ crassitudine, niger, pseudoparenchymaticus, cellulis pachydermeis, 5μ diametro, luminibus 1μ .

Apothecia substipitata, 7-9 mm. diametro, marginibus inflexis, crenatis, excipulo primum laevi dein rugoso subscrobiculato, disco concavo, castaneo; cortex amphithecialis 25μ crassitudine, fastigiatus, gelifactus, granulis brunneis nubilatus; stratum algarum 25μ crassitudine, fere continuum; medulla laxissima; stratum algarum sub parathecio 25μ crassitudine, continuum; parathecium inferne $45-50 \mu$ crassitudine, 30μ ad latera thecii, fastigiatum; hypothecium 30μ crassitudine, hyphis tenuibus periclinialibus, infra laxis, supra densis; thecium 50μ altitudine; paraphyses dichotomae super ascos, apicibus non incrassatis; asci cylindrico-clavati, $42 \times 15 \mu$, pachydermei, apicibus subincrassatis; ascosporae octonae, ellipsoideae, $11 \times 6 \mu$, episporio crasso.

Thallus 12 cm. long, 3.1 cm. wide, completely surrounding a branch of *Coffea*, deep colonial buff when dry, deep olive buff when moist, peripheral lobes plane, 10×5 mm., margins deeply crenate, tips rounded, central portion rugose scrobiculate and bullate with many spermogonia (giving the appearance of pseudostromata of *Pertusaria*); underside black with buckthorn brown margins, shining, slightly rugose, nude in the outer 3 mm.; upper cortex 16μ thick, fastigiate, highly gelified; algal layer 35μ thick, nearly continuous, of colonies of *Trebouxia*, cells spherical, 5μ in diameter, often arranged in vertical rows between medullary hyphae but not filamentous; medulla cream color when long exposed to air, white when freshly exposed with a very narrow ochre-yellow zone next the algal layer, K-, C orange yellow, deeper next the algal layer, KC deeper yellow, 65μ thick, of predominantly longitudinal hyphae, compactly woven under the algal layer and next the lower cortex, hyphae thickwalled, $4-5 \mu$ in diameter, heavily nubilated with brownish granules just under the algal layer; lower cortex $20-25 \mu$ thick, black, pseudoparenchymatous from longitudinal hyphae, very thickwalled, 5μ in diameter, lumina 1μ .

Apothecia substipitate, 7-9 mm. in diameter, margins inrolled, nearly concealing the disc when dry, crenate, exciple smooth at first, becoming rugose and shallowly scrobiculate; disc very concave, chestnut; amphithecial cortex 25μ thick, fastigiate, gelified; algal layer 25μ thick, continuous; medulla very loosely

woven, almost arachnoid; algal layer under the parathecium $25\ \mu$ thick, a few cells penetrating between parthecial hyphae; parathecium $45\text{--}50\ \mu$ thick below tapering to $30\ \mu$ thick at the sides of the thecium, fastigiate, gelified; hypothecium $30\ \mu$ thick, of very slender, periclinal hyphae, loosely woven below, more closely so above; thecium $50\ \mu$ tall; paraphyses slender dichotomous above the asci, tips not thickened, ending $16\ \mu$ below the surface of the brownish epithecial gel; asci clavate then cylindric, $42 \times 15\ \mu$, wall thick, thicker at the tip with a slightly mamillate protoplast when young, 8-spored; ascospores ellipsoidal, $11\text{--}13 \times 6\text{--}8\ \mu$, with a moderately thick episore.

PORTUGUESE EAST AFRICA: Inhambane, Inhamine, ramicole on *Coffea*, D. Luiz Sousa, Oct. 1937, at Kew.

CAPE OF GOOD HOPE: Simon's Bay, Table Mt., on stones, collector not given, no. 306, Herb. Hookerianum at Kew.

PARMELIA (AMPHIGYMNIA) *Dalei* Dodge, sp. nov.

Type: Uganda, Toro, Fort Portal, 1625 m., on *Eucalyptus tereticornis*, I. R. Dale L44, at Kew.

Thallus 4 cm. diametro, flavo-olivaceus, lobis rotundatis, 10 mm. longitudine, 15 mm. latitudine, marginibus integris, subcrenatis, eciliatis, crispatis, laevibus; infra niger, minute reticulatim regulosus, rhizinis brevibus, singulis; cortex superior $10\text{--}12\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, $5\text{--}6\ \mu$ diametro, granulis brunneis nubilatis; stratum algarum $20\text{--}30\ \mu$ crassitudine, subcontinuum, coloniis *Trebouxiae*, cellulis $6\text{--}7\ \mu$ diametro; medulla K-, C roseo, KC-, $100\ \mu$ crassitudine, hyphis longitudinalibus obliquisque, $6\ \mu$ diametro, compacte intertextis; granulis hyalinis nubilatis; cortex inferior $8\text{--}10\ \mu$ crassitudine, pseudoparenchymaticus ex hyphis periclinalibus, $3\ \mu$ diametro.

Apothecia 10 (–15) mm. diametro, stipitibus 2 mm. diametro, 3 mm. altitudine, longitudinaliter rugosis, marginibus crenatis, excipulo minute scrobiculato, disco perforato, rufo-brunneo, aetate rugoso-rimoso; cortex amphithecialis $30\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, gelifactus, protoplastis $3\ \mu$ diametro; stratum algarum $35\ \mu$ crassitudine, continuum, coloniis subdiscretis, cellulis $6\text{--}8\ \mu$ diametro; medulla hyphis sub rugis laxius, inter rugas compactius intertextis; stratum algarum sub parathecio $30\text{--}40\ \mu$ crassitudine, subcontinuum, coloniis discretis; parathecium $15\ \mu$ crassitudine, hyphis periclinalibus conglutinatis; hypothecium $15\ \mu$ crassitudine, hyphis tenuibus periclinalibus non conglutinatis; thecium $60\ \mu$ altitudine; paraphyses tenues, septatae, super ascos dichotomae, ramis moniliformibus, apicibus non incrassatis; asci clavati dein ellipsoideae, leptodermei, $40 \times 16\ \mu$; ascospores octonae, ellipsoideae, $11\text{--}14 \times 7\text{--}8\ \mu$, episporio crasso.

Thallus about 4 cm. in diameter, severally imbricately arranged over an area 16 cm. long and 4 cm. wide, yellowish olive to light yellowish olive, lobes rounded about 10 mm. long and 15 mm. wide, margins entire or slightly crenate, eciliate, crisped, occasionally lobulate from regeneration following breakage, lobules nearly circular, 4–5 mm. in diameter; surface smooth, minutely reticulate rugulose in the center; underside black to the margin or sometimes shading to olive brown on some lobes, minutely reticulate rugulose, rhizinae very short, stout, branching at the tip to form a lobate holdfast, mostly single on the central portion of the thallus;

upper cortex 10–12 μ thick, of thinwalled fastigiate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granules; algal layer 20–30 μ thick, nearly continuous, of colonies of *Trebouxia*, cells 6–7 μ in diameter; medulla K–, C pink, KC–, 100 μ thick, of moderately closely woven, longitudinal and oblique hyphae about 6 μ in diameter, lumina 3 μ , moderately nubilated with hyaline granules throughout, more closely woven and longitudinal next the lower cortex; lower cortex 8–10 μ thick, pseudoparenchymatous from thickwalled, periclinal hyphae 3 μ in diameter.

Apothecia 10 (–15) mm. in diameter, stipes 2 mm. tall, 3 mm. in diameter, longitudinally rugose; margins crenate, exciple minutely scrobiculate, disc perforate, very concave, auburn, nearly flat and rugose in age, the larger ridges cracking nearly to the center, dividing the disc into several sectors; amphithecial cortex 30 μ thick, of gelified fastigiate pseudoparenchyma, protoplasts 3 μ in diameter; algal layer 35 μ thick, of close discrete colonies, forming a continuous layer next the cortex, cells 6–8 μ in diameter, with an occasional cell deeper in the medulla; medulla closely woven between the ridges, loose under the ridges; algal layer under the parathecium 30–40 μ thick, of close, discrete colonies in a nearly continuous layer; parathecium 15 μ thick, of conglutinate periclinal hyphae; hypothecium 15 μ thick of slender septate periclinal hyphae, not conglutinate; thecium 60 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, tips not thickened, ending about 8 μ below the surface of the brownish epithelial gel, a few reaching the surface; asci clavate becoming ellipsoid, $40 \times 16 \mu$, 8-spored, wall relatively thin; ascospores ellipsoid, $11-14 \times 7-8 \mu$, with a moderately thick epispore.

A single thallus in the group has a microphyllin margin on one lobe, lobules 0.3–0.4 mm. in diameter, and the upper surface on one side of the thallus has areas of minute coralloid isidia, scarcely more than coarsely granular isidia, the rest of the thallus and apothecia appear normal for this species. Apparently it is a teratologic specimen, showing regeneration following insect injury, as part of the thecium of one apothecium has been eaten by insects, exposing the medulla.

UGANDA: Toro, Fort Portal, 1625 m., on *Eucalyptus tereticornis*, l. R. Dale L44, at Kew.

PARMELIA (AMPHIGYMNIA) *Zeyheri* Dodge, sp. nov.

Type: Cape of Good Hope, forests toward Grahamstown, terricole, *Zeyher* 2 in Taylor Herb. sub *P. rugosa* Taylor, det. *P. conspersa* by Tuckerman, at Farlow Herb.

Thallus 5 cm. diametro, viridis, lobis periphericis 7×5 mm., rotundatis, marginibus integris, eciliatis, revolutis, laevibus, apocis; centro bullato subcerebriformive; infra niger, apocus, rugosus, rhizinis non visis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis nubilatus; stratum algarum 100 μ crassitudine, continuum, cellulis 10 μ diametro *Trebouxiae*; medulla K–, C–, KC–, 160 μ crassitudine, hyphis longitudinalibus dense intertextis, dimidia parte superiori granulis griseis nubilata; cortex inferior 15 μ crassitudine, niger, fastigiatus, pseudoparenchymaticus, rhizinis 65 μ diametro, ex hyphis medullaribus, cortice tectis.

Apothecia ad 10 mm. diametro, margine integro, subsulcato, involuto, excipulo levi, disco urceolato, castaneo, dein plano nigroque; cortex amphithelialis 15 μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 50 μ crassitudine, sub parathecio 80 μ crassitudine; parathecium 30 μ crassitudine, pseudoparenchymatice fastigiatum sed cellulis sub irregulariter dispositis; hypothecium 25 μ crassitudine, hyphis tenuibus periclinalibus; thecium 70 μ altitudine; paraphyses tenues, septatae, semel bisve dichotomae super ascos, apicibus subincrassatis; asci clavati, pachydermei, 50 \times 15 μ ; ascosporae octonae, ellipsoideae, 9-10 \times 5 μ , episporio crasso.

Thallus at least 5 cm. in diameter, probably larger, sea-foam green, peripheral lobes 7 mm. long, 5 mm. wide, rounded, center concave, margins entire, eciliate, revolute, surface smooth, opaque, central portion very bullate and subcerebriform (resembling pseudostromata of *Pertusaria*) but spermogonia not confined to them; underside black, opaque, very deeply rugose, rhizinae not clearly seen; upper cortex 15 μ thick, of fastigate pseudoparenchyma, so heavily nubilated with brownish granules that structure is rather indistinct; algal layer 100 μ thick, cells 10 μ in diameter, uniformly distributed in a continuous layer, rarely of small colonies of about 10 cells of *Trebouxia*; medulla K-, C-, KC-, 160 μ thick, more loosely woven under the algal layer and heavily nubilated with grayish granules in the upper half, of closely woven longitudinal hyphae, 5-6 μ in diameter, not nubilated in the lower half; lower cortex 15 μ thick, black, of fastigate pseudoparenchyma, pierced by small pores about 7 μ in diameter with a small air space underneath each; rhizinae 65 μ in diameter, formed by medullary hyphae corticate with cells from the lower cortex.

Apothecia up to 10 mm. in diameter, margin entire, very slightly sulcate, in-rolled, sometimes splitting into several segments, exciple smooth, disc urceolate, chestnut, becoming plane and black at maturity; amphithelial cortex 15 μ thick, of fastigate pseudoparenchyma; algal layer 50 μ thick, under the parathecium 80 μ thick, cells more closely packed than in the thalline algal layer; parathecium 30 μ thick, of thickwalled fastigate pseudoparenchyma, but the cells rather irregularly arranged; hypothecium 25 μ thick, of closely woven, slender, periclinal hyphae, deeply staining in the upper half; thecium 70 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, tips very slightly clavate, reaching the surface of the brownish epithelial gel; asci clavate, 50 \times 15 μ , wall nearly 3 μ thick, tip 5 μ , 8-spored; ascospores ellipsoid, 9-10 \times 5 μ , with a moderately thick episore.

MAURITIUS: Ponce Range, on stones and trunks of trees, *Philip B. Ayres*, at Kew.

CAPE OF GOOD HOPE: Uitenhage, *Zeyher* 22 p. p., young, Herb. Hookerianum, at Kew; forests toward Grahamstown, *Zeyher* 2, terricole? (small grains of sand adhering to lower cortex), det. *P. conspersa* by Tuckerman, in Taylor Herb. sub *P. rugosa* Tayl., at Farlow Herb.

PARMELIA (AMPHIGYMNIA) *rimulosa* Dodge, sp. nov.

Type: Cape of Good Hope, Table Mt., corticole, *John MacGillivray*, Voy. Herald, at Kew.

Thallus 6 cm. diametro, dilute ochraceo-alutaceus, lobis periphericis ad 13 mm.

longitudine, irregulariter dichotomis, sinibus rotundatis excisisque, lobulis ultimis aliis 2 mm. longitudine, 1–1.5 mm. latitudine, aliis rotundatis, 7–8 mm. diametro, marginibus dentatis ciliatisque, ciliis 2–3 mm. longitudine; superne laevis ad margines, rugulosus subscrobiculatusque in centro, rimoso-areolatus, ad margines rimorum minute verrucosus, papillatus vel subsidiosus, areolis corticis desquamacentibus; inferne niger, sublaevis, centro paucis cum rhizinis; cortex superior 30 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis pachydermeis, granulis brunneis nubilatis; stratum algarum 30–40 μ crassitudine, coloniis discretis confertis *Trebouxiae*, cellulis 4–5 μ diametro; medulla K–, C–, KC–, 55–80 μ crassitudine, superne hyphis subverticalibus laxae contextis, inferne longitudinalibus, dense contextis, 3 μ diametro, pachydermeis; cortex inferior 40 μ crassitudine, hyphis 4 μ diametro ad medullam, in parte exteram, ramis plus fastigiatis, plus pachydermeis.

Thallus 6 cm. in diameter, light ochraceous buff, peripheral lobes up to 13 mm. long, 4 mm. wide below, irregularly dichotomous with rounded to excised sinuses, ultimate lobules 2 mm. long 1–1.5 mm. wide, some rounded, 7–8 mm. in diameter, margins dentate, ciliate, cilia 2–3 mm. long, upper surface smooth near the margins, rugulose and subscrobiculate toward the center, rimose areolate, minutely verrucose, papillate and subsidiose along the margins of the cracks, with areoles of cortex flaking off in places; underside black to the margins, nearly smooth, rhizinae few, confined to the central portion; upper cortex 30 μ thick, of thickwalled fastigate pseudoparenchyma, heavily nubilated with brownish granules; algal layer 30–40 μ thick, of close, discrete colonies of *Trebouxia*, cells closely packed in a nearly continuous layer above, more scattered below, cells 5–6 μ in diameter; medulla K–, C–, KC–, 55–80 μ thick, hyphae rather loosely woven and subvertical above, longitudinal and more closely woven below, 3 μ in diameter, very thickwalled; lower cortex dark brown, 40 μ thick, of longitudinal hyphae 4 μ in diameter next the medulla, branches more fastigate with thicker walls in the outer portion.

CAPE OF GOOD HOPE: Table Mt., corticole, John MacGillivray, Voy. Herald, at Kew.

PARMELIA (AMPHIGYMNIA) Mellissi Dodge, sp. nov.

Type: St. Helena, corticole, J. C. Melliss, at Kew.

Thallus 12 cm. diametro, dilute ochraceo-alutaceus, lobis periphericis 15 mm. longitudine latitudineque, rotundatis, marginibus crenatis, lobulatisque, ciliatis, ciliis 1 mm. longitudine, superficie laevi, centro rugoso scrobiculatoque, isidiis in rugis fragillimis dein soredia granulosa formantibus; lobis centralibus parvioribus, crispatis imbricatisque, dentatis, ciliatis et isidiosis, isidiis fragillimis, ad 1 mm. longitudine; inferne niger, marginibus nudis brunneis, reticulatim rugosis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis nubilatus; stratum algarum 20 μ crassitudine, subcontinuum, cellulis *Trebouxiae*, 5–6 μ diametro; medulla K–, C–, KC–, 80 μ crassitudine, hyphis leptodermeis, longitudinalibus, 2.5 μ diametro dense contextis; cortex inferior 15 μ crassitudine, nigrobrunneus, hyphis longitudinalibus 3 μ diametro, cellulis isodiametricis.

Thallus at least 12 cm. in diameter, pale ochraceous buff, marginal lobes about 15 mm. wide and long, rounded, margins crenate to lobulate, ciliate, cilia 1 mm.

long, simple, surface smooth at the margin, increasingly rugose and scrobiculate toward the center, isidia on the ridges, very fragile and breaking down into granular soredia; central lobes smaller, variously crisped and folded, imbricate, margins ciliate, dentate to isidiose, the isidia spreading to the adjacent surfaces of the central lobes, up to 1 mm. long but very fragile and breaking down into soredia; underside black, with Brussels brown margins, reticulate rugose, margins nude; upper cortex 15 μ thick, of fastigate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 20 μ thick, nearly continuous, cells 5–6 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of predominantly longitudinal hyphae, 2.5 μ in diameter, thinwalled, moderately closely woven with some oblique or vertical hyphae; lower cortex deep brown, 15 μ thick, pseudoparenchymatous from longitudinal hyphae about 3 μ in diameter, extending to the upper surface of the lobe at the margin.

ST. HELENA: corticole, J. C. Melliss, at Kew.

PARMELIA (AMPHIGYMNIA) *Braunii* Dodge, sp. nov.

Type: Tanganyika, without locality, corticole, growing over hepatics, *Braun*, Inst. Amani 8603, det. *P. perlata* (L.) Nyl. by Hesse in E. African Herb.

Thallus 8 cm. diametro, roseo-alutaceus aut vinaceo-alutaceus, lobis periphericis 30×10 –15 mm., apicibus rotundatis, ciliatis, ciliis 1–1.5 mm. longitudine, lobulis lateralibus 1–5 mm. longitudine, 1–3 mm. latitudine, marginibus fimbriatis, isidiosus, superficies laevis centro isidiosa, isidiis brevibus, fragillimis; infra niger, minute reticulatim rugulosus, marginibus nudis laevibus, nitidis, brunneis; cortex superior 10 μ crassitudine, fastigiatus, hyphis 4 μ diametro, granulis brunneis nubilatis; stratum algarum 10 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 3–4 μ diametro; medulla K–, C rosea, KC rosea, 60 μ crassitudine, hyphis longitudinalibus, compacte intertextis, 4–5 μ diametro, granulis brunneis nubilatis; cortex inferior brunneus, gelifactus, 7–9 μ crassitudine, pseudoparenchymatice fastigiatus, lumina ca. 1 μ diametro.

Thallus 6 cm. in diameter, pinkish buff to vinaceous buff (1957), in type, between ecru olive and dark olive buff, shading toward wood brown on some lobes in the more recently collected *Dale* L53 p. p. min.; peripheral lobes 30 mm. long, 10–15 mm. wide, tips rounded, ciliate, cilia 1–1.5 mm. long, moderately close, lateral lobes variable from 3 mm. wide, 5 mm. long to 1 mm. wide, 1–2 mm. long, margins fimbriate, isidiose; surface smooth isidia in the center of the thallus varying from verrucae to papilliform and rarely dichotomous, very fragile; underside black, shining, minutely reticulate rugulose in the center with groups of moderately dense, short, slender rhizinae, stouter and densely branched at the tips when forming holdfasts in contact with the bark, margins nude, more minutely reticulate rugulose to smooth, nitid, Brussels brown; upper cortex 10 μ thick, fastigate, hyphae 4 μ in diameter, heavily nubilated with brownish granules; algal layer 10 μ thick, of discrete colonies of *Trebouxia*, cells 3–4 μ in diameter; medulla K–, C pink, KC pink, 60 μ thick, of longitudinal hyphae, very closely woven, 4–5 μ in diameter, very heavily nubilated with brownish granules; lower cortex 7–9 μ thick, of gelified fastigate pseudoparenchyma, lumina about 1 μ in diameter, brownish.

From the color of the more recently collected *Dale* L53 p. p. min., perhaps this species belongs in the Subflavescentes section.

UGANDA: Bunyoro, Busingiro, 1125 m., on Jacaranda tree, I. R. Dale p. p. min., at Kew.

TANGANYIKA: without locality, Braun, B. L. Inst. Amani 8603, type, sub *P. perlata* det. Hesse, 8604 sub *P. tinctorum* det. Hesse, both in E. African Herb.

PARMELIA (AMPHIGYMNIA) Manni Dodge, sp. nov.

Type: Ilha Principe, Gustavo Mann, at Kew.

Thallus ca. 17 cm. diametro, obscure olivaceo-alutaceus, lobis periphericis 40 mm. longitudine, flabellatis, inferne 6 mm. latitudine, superne ad 30 mm., marginibus crenatis, crispatis ciliatisque, ciliis 0.5–1.5 mm. longitudine, laevibus, opacis, centralibus rotundatis, 5–10 mm. diametro, marginibus isidiosus, isidia longa, coralloidea, superne isidiosus, isidiis simplicibus brevioribusque; inferne niger, marginibus nudis, brunneis; cortex superior 8 μ crassitudine, pseudoparenchymaticus, cellulis leptodermeis, 3 μ diametro, irregulariter dispositis; stratum algarum 30 μ crassitudine, subcontinuum, cellulis 6 μ diametro; medulla K–, C rosea, KC–, 60 μ crassitudine, hyphis 2 μ diametro, longitudinalibus, confertim contextis, granulis griseis nubilatis; cortex inferior 8 μ crassitudine, nigrobrunneus, pseudoparenchymate fastigiatus, cellulis pachydermeis.

Apothecia 6–7 mm. diametro, stipitibus 1.5–2 mm. altitudine, 1.5 mm. diametro, longitudinaliter sulcatis, marginibus lobulatis, lobulis ad 2 mm. longitudine, 0.1–0.2 mm. latitudine, laceratis, coralloideis cum isidiis; excipulo scrobiculato, coralloideis cum isidiis in rugis, disco concavo, castaneo; cortex amphithecialis 30 μ crassitudine, fastigiatus, hyphis 3 μ diametro, septatis, luminibus 1.5 μ diametro; stratum algarum 20 μ crassitudine, subcontinuum, granulis brunneis nubilatum; medulla hyphis confertim contexta laxius sub strato algarum; stratum algarum sub parathecio coloniis discretis *Trebouxiae*, 15 μ diametro; parathecium 20 μ crassitudine, pseudoparenchymate fastigiatum; hypothecium 20 μ crassitudine, hyphis tenuibus periclinalibus; thecium 65 μ altitudine; asci clavati, 45 \times 13 μ , apicibus juvenute incrassatis; ascosporeae ellipsoideae, 11–13 \times 7–8 μ , episporio tnuis.

Thallus about 17 cm. in diameter, between dark olive buff and deep olive buff, peripheral lobes 40 mm. long, flabellate, 6 mm. wide below, expanding to 30 mm. above, margins crenate, crisped, ciliate, cilia 0.5–1.5 mm. long, surface smooth, opaque; central lobes rounded, 5–10 mm. in diameter, margins isidiose, isidia long coralloid, upper surface with shorter isidia mostly simple; underside black, with Dresden brown nude margins; upper cortex 8 μ thick, pseudoparenchymatous, cells thinwalled, 3 μ in diameter, irregularly arranged; algal layer 30 μ thick, nearly continuous, cells 6 μ in diameter; medulla K–, C pink, KC–, 60 μ thick, of closely woven, longitudinal hyphae, 2 μ in diameter, very heavily nubilated with grayish granules; lower cortex dark brown, 8 μ thick, of thickwalled fastigate pseudoparenchyma.

Apothecia 6–7 mm. in diameter, stipes 1.5–2 mm. tall, 1.5 mm. in diameter, longitudinally sulcate, margins lobulate, lobules up to 2 mm. long, 0.1–0.2 mm. wide, lacerate, growing out as coralloid isidia, exciple scrobiculate with coralloid isidia long the ridges, disc remaining concave, burnt sienna to chestnut; amphithecial cortex 30 μ thick, fastigate, hyphae septate 3 μ in diameter, lumina 1.5 μ ; algal layer 20 μ thick, nearly continuous, very heavily nubilated with brownish

granules; medulla moderately closely woven, looser next the algal layer, heavily nubilated with brownish granules; algal layer under the parathecium of discrete colonies of *Trebouxia*, 15 μ in diameter; parathecium 20 μ thick, of fastigiate pseudoparenchyma; hypothecium 20 μ thick, of very slender, periclinal hyphae, not staining in the lower half; thecium 65 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, ending about 15 μ below the surface of the pale brown epithelial gel; asci clavate cylindric, 45 \times 13 μ , tips and upper half of wall thickened when young; ascospores ellipsoid, 11–13 \times 7–8 μ , with a thin epispore.

ILHA PRINCEPE: *Gustavo Mann*, type, at Kew.

PARMELIA (AMPHIGYMNIA) *Stuhlmanni* Dodge, nom. nov.

Parmelia nitens v. *isidiosa* Müll. Arg., Bot. Jahrb. [Engler] 20:255. 1894.

Type: Tanganyika, Usambara, Ririre Karapo, *Stuhlmann* 3301.

Thallus about 13 cm. in diameter, citrine drab in the center, shading to deep olive buff toward the margins and vinaceous buff in the outer 3 mm., lobes rounded, 10–15 mm. wide, 10 mm. long, margins smooth, to shallowly crenate, not or only slightly isidiose, eciliate, center densely isidiose, isidia simple, short, easily breaking off and the surface appearing coarsely granular under low magnification, upper surface coarsely rugose, rimulose areolate, peripheral lobes smooth and subnitid; underside black, margins buckthorn brown, shining, minutely reticulate rugulose, rhizinae in dense groups near the center, less than 1 mm. long, stout, forming disciform holdfasts about 0.5 mm. in diameter, sometimes concrescent, some growing down from folds and failing to make contact with the substrate, more slender, 2–3 mm. long with acute tips; upper cortex 12 μ thick, of fastigiate thinwalled pseudoparenchyma, cells 4 μ in diameter, nubilated with brownish granules; algal layer 25 μ thick, of single cells 9–10 μ in diameter and small colonies of *Trebouxia* in a nearly continuous layer; medulla K–, C–, KC–, 80 μ thick, of moderately closely woven longitudinal hyphae with some vertical hyphae, 3 μ in diameter, lumina 2 μ , not nubilated; lower cortex black, 12 μ thick, of gelified fastigiate pseudoparenchyma, cells thickwalled, lumina about 2 μ in diameter.

Apothecia submarginal, 13 mm. in diameter, stipe 1 mm. tall, 3 mm. in diameter, smooth; margin entire to slightly crenulate, inflexed; exciple white reticulate and slightly rimulose below, disc chestnut; amphithecial cortex 55 μ thick, fastigiate, hyphae septate, 5–6 μ in diameter, lumina 1.5–2 μ ; algal layer of discrete colonies, nearly continuous in places; medulla closely woven; algal layer under the parathecium 30 μ thick, continuous with a few cells deeper in the medulla; parathecium 20 μ thick, of thickwalled fastigiate pseudoparenchyma; hypothecium 40 μ thick, of periclinal, closely woven hyphae; thecium 60 μ tall; paraphyses septate, dichotomous above the asci, branches moniliform, tips not thickened, reaching the surface of the brownish epithelial gel; asci clavate, 35 \times 15 μ , 8-spored, walls thin, tips thickened when young; ascospores ellipsoid, 11 \times 7 μ , with a moderately thick epispore.

Holst 710 is rather fragmentary with most of the isidia broken off, but it is fertile. It was determined *P. perlata* v. *olivaria* Ach. by Müller Argau, probably

before he published *P. nitens* v. *isidiosa*. The microscopic characters of the apothecia show this taxon to be distinct from *P. nitens* Müll. Arg.

TANGANYIKA: Usambara, C. Holst 710, at Kew.

SOUTHERN RHODESIA: Matapos District, 1610 m., probably on sandstone (quartz grains tangled with the rhizinae), Frederick Eyles 1178, at Kew.

PARMELIA (AMPHIGYMNIA) LOBULASCENS Steiner, v. ISIDIOSISSIMA Dodge, Ann. Missouri Bot. Gard. 40:375. 1953.

Type: Sierra Leone, Sefadu (Gbense), on trunk of *Elaeis guineensis*, P. Adames, com. F. C. Deighton M4754, at Kew.

Thallus about 10 cm. in diameter, 135–150 μ thick, pale olive buff, K faint yellow, irregularly lobed, some lobes rounded up to 15 mm. broad, margin smooth, crisped, sinuses irregularly excised, eciliate, other lobes only 3–5 mm. broad, more erect, margins isidiose of lobulate isidia from granular to coralloid, up to 2 mm. tall, 0.5 mm. in diameter, non isidiose lobules very rare, about 1 mm. long, 0.5 mm. wide, somewhat constricted at the base; underside black, opaque, minutely rugulose; rhizinae about 1 mm. long, black, confined to central portion of thallus, broader lobes shading through chestnut to light brown at the margin, nearly smooth and shining, narrower lobes either rugulose and black to the margin or abruptly white in a narrow zone 1 mm. wide; upper cortex 25 μ thick of thin-walled fastigiate pseudoparenchyma, cells about 6 μ in diameter, smaller toward the outside; algal layer 15–25 (–40) μ thick, cells 6–8 μ in diameter, heavily nubilated; medulla K–, C–, KC–, 65 μ thick, of loosely woven, thickwalled hyphae 3 μ in diameter, more longitudinal and compactly woven below, interstices nearly filled with grayish granules; lower cortex black, 15–25 μ thick, pseudoparenchymatous.

SIERRA LEONE: Sefadu, Gbense, on trunk of *Elaeis guineensis*, P. Adames, com. F. C. Deighton M4754, type, at Kew.

NIGERIA: Charles Barter 503, fragment, Nigher Exp. in Leighton Herb. at Kew.

PARMELIA (AMPHIGYMNIA) PSEUDOTINCTORUM des Abbayes, Bull. Inst. Franç. Afrique Noire 13:973. 1951.

Type: Côte d'Ivoire, Mt. Tonkoni (cercle de Man), 1150 m., des Abbayes; Mankono and Seguela (cercle de Geguela), des Abbayes, all on granite.

Thallus up to 15 cm. in diameter, deep olive buff in the center, a little lighter toward the margins, peripheral lobes rounded, 5–15 mm. wide, subimbricate, margins ascending, somewhat crisped, crenulate, smooth, becoming minutely isidiose toward the base; upper surface smooth to coarsely rugose in the center, very densely isidiose, isidia simple or coralloid, many papilliform, especially toward the marginal lobes where isidia are very rare; underside black in the center to Brussels brown at the margin, rhizinae stout, 1 mm. long or less, in scattered groups in the center of the lobes; upper cortex 15 μ thick, of fastigiate thickwalled pseudoparenchyma, cells 5–6 μ in diameter, outer cells up to 12 μ long, lumina 1 μ in diameter, outer half somewhat nubilated with brownish granules; algal layer of discrete colonies of *Trebouxia*, 15 μ in diameter, cells 6–7 μ in diameter; medulla K–, C pink, KC–, 65 μ thick, of closely woven longitudinal hyphae, 4 μ in diameter, heavily nubilated

with grayish brown granules, less so in the lower 10 μ ; lower cortex black, 15 μ thick, of pseudoparenchyma from longitudinal hyphae 3–4 μ in diameter with very thick dark brown walls.

Apothecia rare, stipe 1 mm. tall, 4 mm. in diameter, slightly longitudinally rugose, up to 10 mm. in diameter, margin and exciple smooth, minutely white reticulate, splitting radially once or twice when old, disc Dresden brown; amphithecial cortex 25 μ thick, fastigiate, gelified, outer half nubilated with brownish granules; algal layer 25 μ thick, continuous; medulla loosely woven, somewhat more compact above; algal layer under the parathecium 25 μ thick, continuous; parathecium 30–35 μ thick, of periclinal, thinwalled hyphae; hypothecium not well differentiated, about 5 μ thick, hyphae thickwalled; thecium 70 μ tall; paraphyses slender, septate, once dichotomous above the asci, branches submoniliform, tips narrowly clavate reaching the surface of the brownish epithelial gel; asci clavate becoming ellipsoid, 30×13 –14 μ , wall and tip about 3 μ thick when quite young, then tips thicken to 6–7 μ with a slightly mamillate protoplast, thinning at maturity; ascospores distichous, ellipsoid, 8 – 11×6 –7 μ with moderately thick episporium.

The description of apothecia is based on *Roberty 12673*. *Zenker 1345* is KC pink.

SIERRA LEONE: Gbense, Sefadu, on trunk of *Elaeis guineensis*, P. Adames, com. F. C. Deighton M4753; Kori, Njala, on branch of *Funtumia africana*, F. C. Deighton M5639, at Kew.

CÔTE D'IVOIRE: Triangle aride de Toumodi, Bouallé sur du Boka de Titiékro, on bark, G. Roberty 12673, fertile, Conserv. Bot. Genève

NIGERIA: *Charles Barter 503*, Niger Exp. in Leighton Herb. at Kew.

CAMEROON: Bipinde, G. Zenker 1345, in Dodge Herb.

FERNANDO PO: Timber bay, on trees, *Charles Barter*, Niger Exp. at Kew.

ILHA PRINCEPE: *Charles Barter, 1894, 1932*, Niger Exp. at Kew.

ANGOLA: Nordeste da Lunda, Dundo, explorações da Companhia de Diamantes de Angola, near Rio Luachimo, 750 m., on branches of tall trees of gallery wood, J. Gossweiler 13928, at Kew; Loanda, Cazengo, J. Gossweiler 4793, at Kew.

UGANDA: Mt. Elgon, 1290 m., W. Small J19 p. p., at Kew.

Var. *perrugosa* (des Abb.) Dodge, comb. nov.

Parmelia pseudotinctorum f. *perrugosa* des Abb., Bull. Inst. Franç. Afrique Noire 13:973. 1951.

Type: Guinée Française, Fouta Djallon, à Dalaba (cercle de Mamou), saxicole, 1200 m., H. des Abbayes.

Surface more rugose, isidia coralloid, more dense in the center of the thallus.

UGANDA: Kigezi, Mafuga, 2580 m., saxicole, I. R. Dale L52, L68 p. p. min.

PARMELIA (AMPHAGYMNIA) *meiosperma* (Hue) Dodge, comb. nov.

Parmelia internexa f. *meiosperma* Hue, Nouv. Arch. Mus. [Paris] IV. 1:185. 1899.

Type: Réunion, Mafate, *Rodrigues*, substrate not given.

Thallus 7 (–22.5) cm. in diameter, pinkish buff in center, shading to olive buff on the margins, center coarsely rugose, lobes rounded, imbricate, 10–15 mm. wide, isidiose, isidia simple or forked, short, fragile, scars resembling pseudocypbellae, marginal isidia coarser, 1 mm. long 0.2–0.4 mm. in diameter, the wider somewhat flattened, tips pale, not becoming sorediose, peripheral lobes rounded, 10–15 mm.

wide, about 10 mm. long, some smooth, coarsely crenate with a very narrow black margin, others dentate with isidial initials, 0.1–0.2 mm. long, without narrow black margin; underside black, minutely reticulate rugulose, shading to antique brown at the margins, rhizinae stout, confined to scattered areas in the center of the thallus, short, expanding at the tips to irregular flattened holdfasts; upper cortex 10–13 μ thick, of fastigate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with greenish brown granules, covered by a thin amorphous layer 2 μ thick; algal layer 20 μ thick, of close discrete colonies of *Trebouxia*, cells 6–9 μ in diameter, some disappearing and leaving lacunae; medulla K–, C pink, KC pink, 115–145 μ thick, of longitudinal thickwalled hyphae 3 μ in diameter, heavily nubilated with grayish granules and very closely woven in the upper portion, very loose and arachnoid without granules in the lower 35 μ ; lower cortex black, 13 μ thick, pseudoparenchymatous from longitudinal hyphae, cells 6–7 μ in diameter.

Apothecia 2–5 mm. in diameter, sessile, cupuliform becoming flattened, margin and exciple densely isidiose, disc dark rufous, imperforate; amphithecial cortex 50 μ thick, of fastigate pseudoparenchyma, cells 6–8 μ ; algal layer 30–40 μ thick, of close but discrete colonies; medulla very loosely woven, more compact next the algal layers; algal layer under the parathecium 30–40 μ thick, continuous; parathecium 30 μ thick, irregularly fastigate pseudoparenchyma with thin walls, more deeply staining in the upper half; hypothecium 20 μ thick, of loosely woven, slender, periclinial hyphae; thecium 80–90 μ tall; paraphyses 1.5 μ in diameter, septate, branched above the asci, tips 3 μ in diameter, ending about 8 μ below the surface of the pale rufescent epithelial gel; asci 64–80 \times 20–22 μ , tip very thick, protoplast long mamillate when young, 6–8-spored; ascospores ellipsoid, 18–20 (–21) \times 10–11 μ .

Our material is sterile except for immature apothecia on the Ayres specimen from Mauritius and the above description of the apothecia is largely a translation of Hue's description amplified by characters observable in the Ayres collection. *Grote 8605* is a thinner plant, although 10 cm. in diameter with the medulla 75 μ thick, more loosely woven with some vertical hyphae, scarcely nubilated with granules, lower cortex only 6 μ thick. While Taylor identified Wight's collection from Mauritius as *P. saccatiloba* Taylor, type from Pitcairn Island, (see p. 180) it is a thinner plant, smaller in most microscopic characters and the medulla reacts pink with C and KC. *P. saccatiloba* is negative to these reagents.

MAURITIUS: without locality, Dr. Wight in Taylor Herb. sub *P. saccatiloba* Tayl., later det. *P. praetervisa* Müll. Arg. by Müller Argau, and *P. latissima* by C. J. Sprague, at Farlow Herb.; duplicate? at Kew in Herb. Hookerianum; Sieber sub *P. latissima-sorediata-isidiophora* ex Herb. Sbarbaro at Farlow Herb.; on the Bruce, on trees, Ayres at Kew; Ponce, Ayres 16 and 2 other collections, at Kew.

COMORO ISLANDS: Anjouan (Johanna) Island, 400 m., truncicole, J. M. Hildebrandt 1866a, at Kew.

RODRIGUEZ ISLAND: I. B. Balfour 2249, Venus Transit Exp., at Kew.

MADAGASCAR: E. Imerina, Andrangolaoka, J. M. Hildebrandt 2148, sub *P. perlata* v. *platyloba* Müll. Arg. det. Müller Argau; Nossi-bé, J. M. Hildebrandt May 1879, sub *P. perlata* v. *coralloides* Mey. & Fw., both ex Herb. Sbarbaro at Farlow Herb.

TANGANYIKA: Kilimanjaro, Bismarck Hill, 1000 m., *Grote* ex herb. E. African Agr. Res. Inst. Amani 8605 sub *P. tinctorum* Despr. in E. African Herb.; Usambara, growing over orchid roots, C. Holst 710 p. p. at Kew.

Var. *Ecklonii* Dodge, var. nov.

Type: Cape of Good Hope, corticole, growing over hepatics, *Ecklon* ex herb. Sonder sub *P. perlata* Ach. in Tuckerman Herb. at Farlow Herb.

Thallus ca. 7 cm. diametro, cremeo-alutaceus, rugosus, lobis periphericis semi-orbicularibus, 12–15 mm. diametro, marginibus crenatis, sinibus obtusis aut rotundatis, lobis centralibus parvioribus, marginibus dentatis vel minute isidiosis, superficie dense isidiosa, isidiis brevibus, simplicibus; infra niger, apocus, marginibus argillaceis, nudis; rhizinae catervatim in centro thalli disposita, crassae, 1 mm. longitudine; cortex superior 13–15 μ crassitudine, fastigiatus, cellulis cylindricis, 4 μ diametro, granulis viridi-brunneis nubilatis; stratum algarum 30 μ crassitudine, coloniis discretis parvis *Trebouxiae*, cellulis 6 μ diametro; medulla K–, C rosea, KC–, 100–130 μ crassitudine, hyphis longitudinalibus, in parte superiori dense, infra laxius contextis; cortex inferior 10–15 μ crassitudine, fastigiatus.

Thallus about 7 cm. in diameter, cream buff, very coarsely rugose, peripheral lobes smooth, nearly semicircular, 12–15 μ wide, 10 mm. long, margins crenate, sinuses obtuse or rounded, central lobes somewhat smaller, margins often dentate or minutely isidiose, surface densely isidiose, isidia short, slender, simple, a few forked near the tips; underside black, opaque, margins clay color to tawny olive, minutely reticulate rugulose; rhizinae stout, about 1 mm. long, in close groups on central portion, with a whorl of short branches at the tips forming the holdfasts; upper cortex 13–15 μ thick, fastigiate, cells cylindric, 4 μ in diameter, heavily nubilated with greenish brown granules, formed by dichotomies of medullary hyphae in the algal layer; algal layer 30 μ thick, of single cells 6 μ in diameter and small colonies of *Trebouxia*, between vertical medullary hyphae; medulla K–, C deep pink, KC–, 100–130 μ thick, of very closely woven longitudinal hyphae in the upper 30 μ , looser and less regular below; lower cortex 10–15 μ thick, fastigiate, black toward the center, almost hyaline at the margin. No apothecia seen.

Anatomically this variety agrees quite closely with *P. meiosperma* but differs in the medulla being KC negative and in the structure of the lower cortex.

SOMALILAND: Libah Mele Mt., 1675 m., above Buja Soldan, 10° 20' N., 43° E., on *Grewia*? twigs, J. B. Gillett 4699 p. p., Abyssinia-Somaliland Boundary Commission, at Kew.

TANGANYIKA: Mulinda forest, s.e. of Tukuyu (New Langenburg), 900 m., on trees growing over roots of *Rangaenis muscicola* (orchid), A. Stolz 2577c; Ufipa, Nkunde-Chapota, 2550 m., on roots of *Diaphananthe pulchella* on *Acacia*, 7 m. up in dense shade, A. A. Bullock 1962 p. p. min., International Red Locust Control Service, at Kew.

NORTHERN RHODESIA: Abercorn, growing over roots of *Crystorchis praetermissa* on *Brachystegia taxifolia* in dense shade of crown, A. A. Bullock 2104 pars, International Red Locust Control Service, at Kew.

CAPE OF GOOD HOPE: hepaticole, *Ecklon*, ex herb. Sonder in Tuckerman Herb. sub *P. perlata* Ach. at Farlow Herb.

PARMELIA (AMPHIGYMNIA) HABABIANA Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Parmelia abessinica v. *sorediosa* Müll. Arg., Flora 68:501. 1885.

Type: Ethiopia, Habab, ramulicole, J. M. Hildebrandt 310 p. p.

Thallus 3 cm. in diameter, attached along the upper surface of the twig, the

rest free, between wood brown and dark olive buff (1957), lobes rounded, 12–13 mm. broad, margins crisped with a more or less continuous band of powdery soredia and 2–3 rows of discrete, hemispheric powdery soredia 0.3–0.5 mm. in diameter, 1–2 mm. inside the margins, never close and confluent, very rare elsewhere on the upper surface, cilia sparse, rather fragile, up to 1 mm. long; surface rugose to shallowly subscrobiculate, partly rimulose along the ridges with a few punctate pseudocyphellae; underside black along the center, then abruptly tawny or darker to the margin, minutely reticulate rugulose; rhizinae few, stout in the center of the thallus, about 2 mm. long, tips pale; upper cortex 25 μ thick, of fastigate pseudoparenchyma, protoplasts spherical, 2 μ in diameter, covered by an amorphous layer 5–6 μ thick, nubilated with pale brown granules; algal layer of discrete colonies of *Trebouxia*, 15 μ in diameter, cells 6–7 μ ; medulla K–, C–, KC–, 130–200 μ thick, upper 50 μ of closely woven, predominantly longitudinal hyphae with an occasional algal cell, the lower 30 μ also closely woven, the middle very arachnoid with large air spaces, hyphae 4 μ in diameter, not nubilated; lower cortex 25 μ thick, of fastigate pseudoparenchyma, cells 6–7 μ in diameter, somewhat irregularly arranged with thick, dark brown walls.

Apothecia 2 mm. in diameter, substipitate, margin powdery sorediose, soredia 30 μ in diameter, exciple smooth, disc Sanford's brown to auburn, concave; amphithecial cortex 50–55 μ thick, of gelified fastigate pseudoparenchyma, lumina about 1 μ in diameter; algal layer of discrete colonies about 15 μ in diameter; medulla closely woven; algal layer under the parathecium 30 μ thick, continuous; parathecium 50 μ thick, of gelified fastigate pseudoparenchyma; hypothecium 15 μ thick, of slender, closely woven periclinal hyphae; thecium 65 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, tips pyriform $9 \times 3 \mu$, ending about 5 μ below the surface of the brownish epithecial gel; asci clavate, $65 \times 15 \mu$, thickwalled; ascospores ellipsoid, $13\text{--}16 \times 6\text{--}7 \mu$.

In the portion of the apothecium sectioned, the thecium is somewhat moribund, the measurements of the ascus were taken from a young ascus with the protoplast just beginning to cleave. The spores measured were mature, adherent to the surface of the epithecial gel, although there is a possibility that they may have been foreign spores. *Hildebrandt* 310 p. p. is stated by Gyelnik to have come from Habab, but the two collections of this number available to me were both from Bagla, both ramulicole and determined by Müller Argau as *P. abessinica* v. *sorediosa*. Another specimen from Bagla without collector's number, also identified by Müller Argau, is in better condition and fertile and has been used in writing the above description of apothecia. *Pegler* 1231 is somewhat paler with the underside of the margins warm buff.

SOMALILAND: Libah Mele Mt. above Buja Soldan $10^{\circ} 20' \text{ N.}, 43^{\circ} \text{ E.}$, 1675 m., on *Grewia?* sp., J. B. Gillett 4607; ridge southeast of Andoba, $9^{\circ} 59' \text{ N.}, 43^{\circ} 04' \text{ E.}$, 1740 m., on *Euphorbia* trunk, J. B. Gillett 4607 p. p., both Abyssinia-Somaliland Boundary Commission at Kew.

ETHIOPIA: Bagla, 2415 m., ramulicole, J. M. Hildebrandt 310 p. p. and another without collector's number, both sub *P. abessinica* v. *sorediosa* Müll. Arg., det. Müller Argau, at Farlow Herbarium; without locality data nor collector, 25 VII 1957, C.B.E.E., at Kew; Haramat District, near Geraz on *Euphorbia* Collquall, W. P. Schimper, Iter Abyssinicum

Sect. II, no. 1396 sub *P. perlata* v. *coniocarpa* Fw. at Kew (see note under *P. Allenii* Dodge, p. 151).

KENYA: buffalo country south of Narossaro (Narosura?), 1610–2250 m., corticole, *Anita Grosvenor Curtis 700*, in Dodge Herb.

UGANDA: Kigezi, Mafuga, 2415 m., on trees, *I. R. Dale L8, L50* p. p. min., at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida*, *Alice Pegler 1231* p. p., lower right plant, at Kew.

PARMELIA (AMPHIGYMNIA) imerinensis Dodge, sp. nov.

Type: Madagascar, East Imerina, *J. M. Hildebrandt*, Dec. 1880, corticole, ex herb. Sbarbaro, at Farlow Herb.

Thallus ad 15 cm. diametro, obscure olivaceo-alutaceus, lobis periphericis rotundatis, 15 mm. latitudine, 20 mm. longitudine, crenatis, sinibus non excisis, crispatis, laevibus, subnitidis, imbricatis; lobis centralibus minoribus, marginibus lateralibus saepe revolutis, terminalibus adscendentibus, crispatis, lobulatis, sinibus excisis, lobulis 1×1 mm., capitatis cum soraliis 1–1.5 mm. diametro, non confluentibus; supercicies minute rimuloso-areolata, sparsis cum soraliis 0.5 mm. diametro, eciliatus; infra niger, marginibus cinnamoneo-alutaceis umbrinisve, rhizini-bus brevibus, 0.5 mm. longitudine; cortex superior 30 μ crassitudine, fastigiatus, cellulis exteris $15 \times 5 \mu$, interis isodiametricis; stratum algarum 15 μ crassitudine, continuum granulis griseo-brunneis nubilatum; medulla K flava, C–, KC–, 80 μ crassitudine hyphis pachydermeis longitudinalibus, 3 μ diametro, irregulariter nubilatis, compacte intertextis; cortex inferior 7–10 μ crassitudine, gelifactus, cellulis isodiametricis 7–10 μ . Apothecia non visa.

Thallus at least 15 cm. in diameter, probably larger, deep olive buff, peripheral lobes rounded, about 15 mm. wide, 20 mm. long, deeply crenate, sinuses not excised, margins somewhat crisped, surface smooth, subnitid, imbricate; central lobes smaller, lateral margins often revolute, terminal margins ascending, very crisped and lobulate with excised sinuses, lobules 1 mm. long and wide, bearing large capitate soralia 1–1.5 mm. in diameter, never confluent along the margins; surface opaque, minutely rimulose areolate, with scattered patches of soralia up to 0.5 mm. in diameter, wholly eciliate; underside black shading to Saccardo's umber to tawny olive or cinnamon buff at the margins; rhizinae stout, less than 0.5 mm. long; upper cortex 30 μ thick, fastigiate, outermost cells $15 \times 5 \mu$, others isodiametric, partly crushed and invaded by proliferating algal cells and small colonies in the lower 10 μ ; algal layer 15 μ thick, continuous, very heavily nubilated with brownish granules, cells 4–5 μ in diameter; medulla K slowly deep yellow, C–, KC–, 80 μ thick, of longitudinal, thickwalled hyphae, 3 μ in diameter, closely woven with thin air spaces under the algal layer; heavily but irregularly nubilated; lower cortex 7–10 μ thick, of a single layer of cells, highly gelified. Apothecia not seen.

This species seems related to *P. cristifera* Taylor from India, (see p. 178), having the same chemical reactions and soredia on the upper surface as well as marginal, but it is smaller in all dimensions and has a different structure of the upper cortex. The Mauritius specimen consists of parts of two thalli, one growing on a small branch, consisting of central lobes, the other growing on a much larger branch or small trunk, between maize yellow and cream color, has only the peripheral lobes; both without superficial soredia.

MADAGASCAR: East Imerina, J. M. Hildebrandt, Dec. 1880, sub *P. perlata* v. *olivaria* det. Müller Argau, ex herb. Sbarbaro, at Farlow Herb.

MAURITIUS: Reduit, G. Orian 7, at Kew.

SOUTH AFRICA: British Kaffiraria, T. Cooper 1513, sub *P. latissima* v. *sorediata* Nyl., det. Müller Argau, at Kew.

PARMELIA (AMPHIGYMNIA) PEDICELLATA Steiner, Sitzungsber. K. Akad. Wiss. Wien, Math. Naturw. Cl. 106:1:214. 1897.

Type: Kenya, Machakos, Liechtenstein.

Thallus 8 cm. or more in diameter, ashy glaucous becoming light buff, peripheral lobes semicircular, about 5 mm. in diameter, margins crisped, crenate, sparsely ciliate, cilia about 2 mm. long, rarely forked, surface smooth, central lobes capitate sorediate, soon confluent, soralia confined to the margins, very crisped, surface reticulate rimulose, rugulose toward the center; underside reticulate rugulose, black with scattered groups of long stout rhizinae, margins nude sometimes black to the margin, sometimes shining antique brown; upper cortex 15 μ thick, of fastigate pseudoparenchyma, cells 3–4 μ in diameter, protoplasts about 2 μ , nubilated with brownish granules in the outer portion; algal layer of scattered colonies of *Trebouxia*, about 15 μ in diameter; medulla K yellow, C-, KC more intense yellow, 55 μ thick, of rather closely woven longitudinal, thickwalled hyphae, 5–6 μ in diameter; lower cortex black, 30 μ thick, of thickwalled fastigate pseudoparenchyma, cells 6 μ in diameter.

Apothecia urceolate 6–10 mm. in diameter, stipe 2 mm. tall, 3 mm. in diameter, longitudinally deeply sulcate; margin thin, sorediose; exciple reticulate rugose, subscrobiculate below, smooth above, disc chestnut, perforate; amphithecial cortex 11–16 μ thick, fastigate, gelified, heavily nubilated with brownish granules; algal layer 55 μ thick, nearly continuous; medulla loosely woven; algal layer under the parathecium 40–60 μ thick, continuous; parathecium 15 μ thick, of relatively thinwalled, fastigate pseudoparenchyma; hypothecium 15 μ thick, of slender periclinal, rather loosely woven hyphae; thecium 80 μ tall; paraphyses septate, dichotomous above the asci, branches submoniliform, tips clavate, reaching the surface of the brownish epithelial gel; asci clavate, about 55 \times 15 μ , tips greatly thickened, protoplasts mamillate when young; ascospores ellipsoid, 13–19 (–20) \times 7–10 μ (14–16 \times 8–11 μ in our South African specimen), with a thick episore.

UGANDA: Mt. Elgon, Jackson's Peak, 4580 m., on rocks at summit, R. A. Dümmer 3397, Dümmer-Maclennan Exp., sterile, at Kew.

SOUTH AFRICA: Kentani District, Alice Pegler, ex S. African Mus. 21 July 1917, fertile, at Kew.

Var. *isidiosa* Dodge, var. nov.

Type: Uganda, Bugishu, Bulambuli, 2900 m., in bamboo forest, A. S. Thomas 549 p. p. min.

Thallus 12 cm. diametro, olivaceo-alutaceus vel pallidior, lobis periphericis 20 mm. longitudine, 15 μ latitudine, apicibus rotundatis vel subcrenatis, sparsim brevementerque ciliatis, lobis centralibus isidiis, isidiis simplicibus furcatisve, brevibus, tenuibus; infra niger, rhizinis brevibus, marginibus nudis, inter cinnamomeo-alutaceis et avellaneis; cortex superior 8 μ crassitudine, fastigiatus, cellulis 8 \times 5 μ ,

leptodermeis, granulis brunneis nubilatis; stratum algarum 15–16 μ crassitudine, continuum, cellulis 7–8 μ diametro; medulla K flava, C–, KC intense flava sub-aurantiacave, 60 μ crassitudine, hyphis pachydermeis longitudinalibus, densis, 5–6 μ diametro, irregulariter granulis dilute brunneis nubilatis; cortex inferior 15 μ crassitudine, nigro-brunneus, pseudoparenchymaticus ex hyphis longitudinalibus. Apothecia non visa.

Thallus about 12 cm. in diameter, olive buff to pale olive buff, peripheral lobes 20 mm. long, 15 mm. wide, tips rounded or very slightly crenate, sparingly very short ciliate, isidia abundant in the central portion, rare on peripheral lobes, simple or forked at the tips, very short and slender; underside black, short rhizinoe, margins nude, between cinnamon buff and avellaneous; upper cortex 8 μ thick, fastigiate, a single layer of cells $8 \times 5 \mu$, thinwalled, slightly nubilated with brownish granules; algal layer 15–16 μ thick, continuous, cells 7–8 μ in diameter; medulla K yellow, C–, KC intense yellow verging on orange, 60 μ thick, of moderately closely woven longitudinal hyphae, 5–6 μ in diameter, thickwalled, heavily but irregularly nubilated with pale brownish granules; lower cortex 15 μ thick, dark brown, pseudoparenchymatous from moderately thickwalled longitudinal hyphae. Apothecia not seen.

UGANDA: Bugishu, Bulambuli, 2900 m., in bamboo forest, A. S. Thomas 549 p. p. min. at Kew.

PARMELIA (AMPHIGYMNIA) *nigrireagens* Dodge, sp. nov.

Type: Uganda, Western Province, Toro District, Ruwenzori, Kikandara, 3500 m., ramicole, H. A. Omaston 3766c, at Kew.

Thallus 5 cm. diametro, inter viridis Theae et griseus mineralis, K flavo-aurantiacus, lobis semiorbicularibus, 20 mm. diametro, crispatis, marginibus ciliatis, ciliis 1.5–2 mm. longitudine, crenatis, sinibus rotundatis, saepe capitato-sorediosis, mox confluentibus; infra niger, minute reticulatim rugulosus, marginibus laevibus, nitidis, rhizinis raris, crassis, brevibus; cortex superior 15–20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 5–6 μ diametro; stratum algarum coloniis sparsis discretis *Trebouxiae*, 15 μ diametro, cellulis 6–7 μ diametro; medulla K nigra, C–, KC nigra, 30 μ crassitudine, hyphis longitudinalibus dense intertextis, 2–3 μ diametro, non nubilatis; cortex inferior obscure brunneus, 8 μ crassitudine, stratum cellularum singularum isodiametricarum ex hyphis longitudinalibus. Apothecia non visa.

Thallus 5 cm. in diameter, between tea green and mineral gray, K yellow orange, lobes semicircular, 20 mm. in diameter, crisped, margins ciliate, cilia 1.5–2 mm. long, not dense, crenate with rounded sinuses, often capitate sorediate, soon confluent; underside black, minutely reticulate rugulose, shading to Dresden brown at the smooth, shining margins, rhizinae rare, short, stout, forming disciform holdfasts in contact with the substrate, otherwise longer, more slender, resembling the cilia; upper cortex 15–20 μ thick, of thinwalled, fastigiate pseudoparenchyma, cells 5–6 μ in diameter; algal layer of scattered discrete colonies of *Trebouxia*, 15 μ in diameter, cells 6–7 μ , with occasional cells deep in the medulla; medulla K black, C–, KC black, 30 μ thick, of longitudinal, closely woven hyphae 2–3 μ in diameter,

not nubilated; lower cortex dark brown, 8 μ thick, of isodiametric cells from longitudinal hyphae in a single layer.

ETHIOPIA: near Ankober, Dr. Robr, sub *P. perforata* Ach. det. Müller Argau, at Kew.

CONGO: Mt. Kahusi, 2700 m., on twigs, F. L. Hendrickx 4314 p. p. min. in E. African Herb.

UGANDA: North Mengo, 7 miles north of Nakasongola, 1255 m., ramulicole, I. Langdale-Brown 343, at Kew; Western Province, Toro District, Ruwenzori, Kikandara, 3500 m., ramicole, H. A. Omasion 3766c, type, at Kew.

PARMELIA (AMPHIGYMNIA) Pooli Dodge, nom. nov.

Parmelia proboscidea v. *sorediifera* Müll. Arg. Flora 67:615. 1884.

Parmelia perlata f. *sorediifera* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888-9:156. 1890, nom nud.; Müll. Arg., Flora 74:382. 1891.

Imbricaria perlata v. *sorediifera* Jatta, Nuovo Giorn. Bot. Ital. N. S. 9:468. 1902.

Type: Not designated, Madagascar, J. M. Hildebrandt, and Australia, Clarendon, Tepper cited.

Thallus 12 cm. in diameter, drying light buff to cream color, peripheral lobes 10 mm. wide, rounded, margins very crisped, crenate with rounded sinuses, ciliate, cilia about 6 mm. long, mostly simple, some forked in the middle, close, surface smooth, subnitid; central lobes somewhat smaller, margins very crisped, capitate soraliate at first, soredia soon confluent in a continuous band, surface somewhat reticulate rimulose toward the center; underside black to the margins, or antique brown margins with a pale buff band below the soredia, very faintly rugulose, rhizinae rare, single, long, resembling cilia but stouter; upper cortex 15 μ thick, of thinwalled fastigate pseudoparenchyma, cells 5-6 μ in diameter, heavily nubilated with brown granules; algal layer 15 μ thick, continuous, cells 6 μ in diameter, nubilated with hyaline granules; medulla K-, C red, KC-, 55 μ thick, of closely woven, very thickwalled longitudinal hyphae 3 μ in diameter, so heavily nubilated with hyaline granules that structure is visible only in very thin sections; lower cortex 15 μ thick, of fastigate pseudoparenchyma, cells 5 μ in diameter, somewhat irregularly arranged.

MADAGASCAR: Tananarive (Antananarivo), W. Pool, at Kew.

PARMELIA (AMPHIGYMNIA) SUBCILIARIS (Vainio) Dodge, Ann. Missouri Bot. Gard. 40:377. 1953.

Parmelia nilgherrensis v. *subciliaris* Vainio, Hedwigia 37:(40). 1898.

Type: Uganda, Mt. Ruwenzori, 0° 5' S., 3000-3200 m., G. F. Scott-Elliott 218.

Thallus about 4 cm. in diameter, pale olive buff, lobes about 10 mm. broad, margins crenulate, upper surface K yellow, smooth to slightly impressed, rugulose, minutely rimulose areolate in older portions, ciliate, cilia about 2 mm. long, simple or once dichotomous, margins of some lobes capitate soraliate, soralia about 1 mm. in diameter, rarely subconfluent; underside rugulose, black, somewhat lighter toward the margins; upper cortex 40 μ thick, of fastigate pseudoparenchyma, cells about 6 μ in diameter; algal layer 25 μ thick, cells 7 μ in diameter; medulla K-, C pink, KC-, 140 μ thick, of thickwalled, mostly longitudinal hyphae 6-7 μ in

diameter; lower cortex $50\ \mu$ thick, black, pseudoparenchymatous, cells $4\ \mu$ in diameter; rhizinae $60\ \mu$ in diameter, 3–5 mm. long, relatively few in the middle of the thallus, twice to thrice dichotomous.

Apothecia up to 9 mm. in diameter, rather rare, urceolate with margins incurved at first, becoming nearly plane, short stipitate; margin entire, exciple subscrobiculate, not sorediate; disc perforate, Hay's maroon or darker; amphithecial cortex 20–25 μ thick, fastigiate, hyphae $3.5\ \mu$ in diameter, lumina $1\ \mu$, sparsely septate; algal layer 25 μ thick, of discrete colonies of *Trebouxia*, nearly continuous, occasionally pushing up between the cortical hyphae as if they might eventually form soredia on the exciple; medulla very lax; algal layer under the parathecium of scattered, discrete colonies up to 20 μ in diameter; parathecium 30 μ thick, of fastigiate, thickwalled pseudoparenchyma; hypothecium 10–13 μ thick, of gelified periclinal hyphae, scarcely staining; thecium 65 μ tall; paraphyses slender, conglutinate, septa not visible, simple or once dichotomous above the asci, terminal cells clavate, brownish; asci cylindric-clavate, thickwalled, protoplast long mamillate, tip nearly $10\ \mu$ thick when young, $50 \times 15\ \mu$, normally 8-spored; ascospores broadly ellipsoid, $13 \times 10\ \mu$ with a thick epispore, up to $19 \times 10\ \mu$ when some of the ascospores abort, monostichous at first, becoming subdistichous.

ETHIOPIA: Chokke Mts., $10^\circ 40' N.$, $37^\circ 45' E.$, corticole in *Erica arborea* zone below Talo, R. G. Hiller 185, C.B.E.E., at Kew.

CONGO: Kivu, route Kabare-Walungo, ramicole, G. Troupin 2551 pars, at Kew; Kahusi, 2700 m., F. L. Hendrickx 4142, 4305 p. p. min. in E. African Herb.

KENYA: Kinango, 2250 m., growing over bryophytes on forest trees, Allen Turner 6388, ex Coryndon Mus., at Kew; Eldoret, 2220 m., on uliowa tree growing over roots of *Polystachya spatella*, G. R. Williams 90A p. p. min., at Kew; Guaso Nyiro, ramulicole, G. M. Allen 1831 p. p. in Dodge Herb.

UGANDA: Kigezi, Mt. Mgahinga, 3380 m., on *Hypericum* trees with bryophytes, A. S. Thomas 2431; Mafuga, 2415 m., corticole, I. R. Dale L50a; Naiguru, 2255 m., I. R. Dale L62 p. p. min.; Western Province, Ruwenzori, Toro District, ridge forest on Nyinbitaba, 2500 m., on orchid roots, H. A. Omasion 1184; Ruizi River, 1385 m., corticole, T. Jarrett 402 p. p. min.; all at Kew; forest on Kanungu road, A. Burnet L39b, Makerere College Herb.

TANGANYIKA: Usambara, Amani, 1000 m., on main axes of *Usnea distensa* Stirton, P. J. Greenway 998 p. p. min.; Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna*, A. A. Bullock 1871 p. p. min., International Red Locust Control Service, both at Kew.

NYASALAND: Cholo Mt., 1400 m., saxicole in rain forest, L. J. Brass 17697, Vernay Nyasaland Exp. in Dodge Herb.

PARMELIA (AMPHIGYMNIA) NATALENSIS Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:515. 1926.

Type: S. Africa, Natal, Drackensberge, Van Reenen's Pass, Schwarzer Berg, 1700 m., on *Podocarpus*, *Brunnthaler*.

Thallus up to 20 cm. in diameter, pale glaucescent, greener when moist, center dirty argillaceous, appressed and radiately plicate, smooth, subnitid at the margins, subpunctate and rimulose areolate in the older portions, ciliate, cilia simple or dichotomous, about 2 mm. long; marginal lobes up to 20 mm. wide, rounded or more or less cuneiform, somewhat crenulate, sinuses acute, central lobes more deeply crenate, subimbricate and capitate soraliate, soralia subspheric, up to 1 mm. in diameter, with much smaller soralia developing rarely on some of the older central

lobes; underside black, minutely reticulate rugose, margins bister, rhizinae dense in spots on central lobes; upper cortex 9–13 (–22) μ thick, of fastigate pseudoparenchyma, cells 5–6 μ in diameter, densely nubilated with brownish granules; algal layer about 30 μ thick, with algal cells penetrating deep in the medulla under diameter; medulla K–, C–, KC reddening, soon fading, 55 μ thick, of longitudinal hyphae moderately closely woven, less so just under the algal layer (tearing easily on sectioning), thickwalled, 2–4 μ in diameter; lower cortex 9–20 μ thick, very dark brown, of longitudinal thickwalled hyphae about 4 μ in diameter.

Apothecia rare on central portion of the thallus, 3–4.5 mm. in diameter, urceolate, margin incurved, sorediose, finally splitting radially, constricted below but not stipitate, disc fuscous, imperforate, virescent when moistened; amphithecial cortex 30–38 μ thick below, thinning to 20 μ on sides and 15 μ at the margin, fastigate, hyphae 4–5 μ in diameter, thinner walled than in the thalline cortex; algal layer about 30 μ thick, with algal cells penetrating deep in the medulla under the soredia; algal layer under the parathecium 30 μ thick; parathecium 35 μ thick, of fastigate pseudoparenchyma, cells 4–5 μ in diameter; hypothecium 15 μ thick, of conglutinate, periclinal hyphae; thecium 45–48 μ tall; paraphyses filiform, 2–2.5 μ in diameter, branched, tips clavate, up to 3.7 μ in diameter; asci broadly clavate, 44–50 μ long, 8-spored, tips thickened; ascospores ellipsoid, 11–17 \times 8–10 μ , with a thin epispore.

Spermogonia immersed, subspherical, up to 150 μ in diameter, perifulcrum thicker and blackened about the ostiole; spermatophores branched; spermatia bacilliform, 7–10.5 \times 0.5–0.7 μ .

Our specimens are sterile except *I. R. Dale* L43 p. p. from Uganda which has young apothecia, but the asci are too young to show ascospores. The description of apothecia and spermogonia is largely compiled from the original description. All our specimens agree in thalline characters except the fragmentary *Wilms* 2705 which has the medulla KC–.

SOMALILAND: Libah Mele Mt., 1675 m., above Bjua Soldan, 10° 20' N., 43° E., on twigs of *Grewia?* sp., *J. B. Gillett* 4699 p. p. min., Abyssinia Somaliland Boundary Commission, at Kew.

KENYA: Guaso Nyiro, on twigs, *G. M. Allen* 1831 p. p. min. in Dodge Herb.; Kericho, without collector, at Kew.

UGANDA: Ruizi River, 1385 m., tangled with *Usnea trichodeoides* Vainio, *T. Garrett* 402 p. p. min.; Elgon, Madangi, 3550 m., on heath trees, *A. S. Thomas* 607 p. p. min., ex herb. Dept. Agr. Uganda, at Kew; Kigezi, Kasatoro, Kabale River, 2255 m., on tree, *I. R. Dale* L43 p. p. min., at Kew.

ANGOLA: Dundo near Rio Luachimo, 700 m., (Nordeste de Lunda, Circunscrição de Chitato, on branches of tall trees in gallery woods, *J. Gossweiler* 13654a, fragment, at Kew.

TRANSVAAL: Hout Bosch Berg, tropic of Capricorn, com. *W. Nelson* Aug. 1880, det. *P. latissima* v. *ciliata* Nyl. by Müller Argau, at Kew; Lydenburg District, near Lydenburg, *F. Wilms* 2705, at Kew.

CAPE OF GOOD HOPE: without locality or collector, herb. Hookerianum at Kew.

PARMELIA (AMPHIGYMNIA) Sieberi Dodge, sp. nov.

Parmelia perlata v. *praegrantis* Laurer, herb. nom.

Type: Mauritius, *Sieber*, Crypt. Exot. 44, corticole, ex herb. Sbarbaro, at Farlow Herb.

Thallus 35–45 cm. diametro, centro cinnamoneo-alutaceus (1957), marginibus olivaceo-alutaceis, K flavus; lobis radiantibus, imbricatis, 120×45 mm., longitudinaliter rugosus, lateribus crispatis sorediosis, soralia sphaerica, ad 1 mm. diametro, dein confluentia, raris cum ciliis ad 2 mm. longitudine, apicibus crenatis, eciliatis, non sorediosis; infra niger, opacus, marginibus brunneis; rhizinis non visis; cortex superior 15μ crassitudine, fastigiatus, cellulis $10 \times 4-5 \mu$; stratum algarum $13-15 \mu$ crassitudine, cellulis *Trebouxiae* $6-7 \mu$ diametro; medulla K-, C-, KC-, 60μ crassitudine, hyphis longitudinalibus $6-7 \mu$ diametro, superne compactioribus, inferne laxioribus; cortex inferior 10μ crassitudine, pseudoparenchymaticus, ex hyphis periclinalibus. Apothecia matura non visa.

Thallus 35–45 cm. in diameter, cinnamon buff in the center, shading to deep olive buff on the marginal lobes, K yellow, C bleaching to white; peripheral lobes radiating, imbricate, about 120 mm. long, up to 45 mm. wide, coarsely longitudinally rugose, margins of the lobes very crisped and sorediose, some soralia spherical up to 1 mm. in diameter, mostly confluent into a continuous thick marginal band, with an occasional marginal cilium up to 2 mm. long, ends of the lobes coarsely crenate, eciliate, smooth, not sorediose; surface smooth, not rimose in the older portions; underside black, opaque shading to a shining auburn margin 5 mm. wide or sometimes with a white band below the soralia on the sides of the lobes; rhizinae coarse, short; upper cortex 15μ thick, fastigiate, cells $10 \times 4-5 \mu$ at the tips of dichotomous hyphae rising from the medulla, the interstices filled with algal cells forming a layer $13-15 \mu$ thick, cells $6-7 \mu$ in diameter; medulla K-, C-, KC-, 60μ thick, of longitudinal hyphae $2-3 \mu$ in diameter, moderately closely woven above, somewhat more loosely so next the lower cortex, heavily nubilated with grayish granules; lower cortex 10μ thick, black, pseudoparenchymatous from periclinal hyphae, reaching up the sides of the lobes to the bottom of the algal layer. Only a few apothecial initials seen.

Another specimen of Sieber, Crypt. Exot. 44 is smaller, about 22 cm. in diameter, with shorter and narrower outer lobes, also from the Sbarbaro Herb. The Madagascar material is still deep olive buff almost to the center, probably from being a much more recent collection. The Robillard specimen from Mauritius consists of fragments of a much younger plant, perhaps not more than 20 cm. in diameter.

MAURITIUS: Sieber, Crypt. Exot. 44 sub *P. perlata* v. *praegrans* Laur., herb. nom., type, ex herb. Sbarbaro, and sub *P. perlata* v. *grandis* Laur. in Tuckerman Herb.; Robillard, sub *P. cristifera* Tayl. det. Müller Argau; Dr. Wight sub *P. cristifera* Taylor, det. Taylor in Taylor Herb.; all at Farlow Herb.; Ponce, Ayres, at Kew.

MADAGASCAR: Province de Mandinitara, native collector, sub *P. latissima* v. *sorediata* Nyl., ex herb. E. G. Paris and Hasse, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) HILDEBRANDTII Krmphbr., Linnaea 41:61. 1877.

Parmelia Hildebrandtii v. *sorediosa* Müll. Arg., Flora 74:376. 1891.

Type: Comoro Islands, Anjouan (Johanna) Island, 400 m., J. M. Hildebrandt 1866c.

Thallus up to 16 cm. in diameter, pale olive buff to olive buff, peripheral lobes subimbricate, 30 mm. long, 15 mm. wide, margins crisped, slightly crenate, eciliate,

central lobes very crisped, suberect, capitate soraliate becoming confluent; underside black with snuff brown margins, minutely reticulate rugulose; rhizinae very short, in dense groups in the center of the thallus; upper cortex 30 μ thick, fastigiate, not conglutinate, hyphae 6 μ in diameter, rather thinwalled, heavily nubilated with greenish brown granules; algal layer about 30 μ thick, of close, discrete colonies of *Trebouxia* in a nearly continuous layer; medulla K yellow then red, C-, KC yellow then red, 185 μ thick, of very thickwalled longitudinal hyphae, 6 μ in diameter, very heavily nubilated, with brownish granules, very closely woven above, somewhat looser below; lower cortex 30 μ thick, black, of interlaced strands of dark brown hyphae, 3 μ in diameter, with air spaces; rhizinae 55 μ in diameter.

Apothecia subpedicellate, crateriform, margin inflexed, crenulate, exciple nude or more often sorediate, disc concave, pale flesh color, rarely flattened; amphithelial cortex 30 μ thick, of fastigiate pseudoparenchyma, cells 8 μ in diameter with moderately thick walls, disappearing over large areas being replaced by soredia; algal layer of discrete colonies, 30 μ in diameter; medulla very loosely woven, hyphae nubilated with yellow brown granules; algal layer under the parathecium 30-40 μ thick, continuous; parathecium 30 μ thick, of periclinal, thickwalled hyphae, 3 μ in diameter; hypothecium 8 μ thick, scarcely differentiated from the parathecium except the hyphal walls thinner and protoplasts more deeply staining; thecium 65 μ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches not moniliform, tips not thickened, reaching the surface of the brownish epithelial gel; asci clavate, about $40 \times 10 \mu$, tips thickened; ascospores short ellipsoid, $11-15 \times 10-12 \mu$, with a thick episore.

Scott Elliott notes the native name "tainkwaka." "The powder with juice of citron and another plant said by natives an important medicine in primary syphilis."

TANGANYIKA: Kilimanjaro 1610 m., *H. H. Johnston* sub *P. perforata* v. *ulophylla* Mey & Fw., at Kew.

TRANSVAAL: Lydenburg District, near Lydenburg, on trees, *F. Wilms* 2713, at Kew, fertile.

NATAL: Umgoe Mts., *R. W. Plant* sub *P. perlata* v. *ciliata* f. *sorediifera*, det. Müller Argau, at Kew, left hand specimen.

RODRÍGUEZ ISLAND: *I. B. Balfour*, Venus Transit Exp., sterile, at Kew.

MADAGASCAR: *G. F. Scott-Elliott* 2797, det. *P. latissima* v. *sorediata* by Müller Argau, at Kew.

PARMELIA (AMPHIGYMNIA) *Allenii* Dodge, sp. nov.

Parmelia perlata v. *coniocarpa* Flotow, in Schimper, *Iter Abyssinicum* 2: no. 1396. 1842, nom. nud.

Parmelia perforata f. *coniocarpa* Flotow, *Linnaea* 17:17. 1843, nom. nud.

Type: Kenya, Lake Ngunga, 1775 m., on trees, *G. M. Allen* 1837, in Howe Herb. at Farlow Herb.

Thallus 13 cm. diametro, obscure olivaceo-alutaceus, marginibus pallidoribus, lobis periphericis rotundatis, 10 mm. longitudine, 20 mm. latitudine, crenatis, eciliatis, subcrispatis; lobis centralibus suberectis, crispatis, lobulis sparsis 1-2 mm. diametro, capitato-soraliatis, ad 1 mm. diametro, dein confluentibus; infra niger, reticulatum rugulosus, subnitidus, rhizinis 1 mm. longitudine, marginibus brunneis;

cortex superior 10–15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 3–4 μ diametro, granulis brunneis nubilatis; stratum algarum 30 μ crassitudine, coloniis caespitosis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C superne rosea inferne negativa, KC–, 80 μ crassitudine, hyphis longitudinalibus 3 μ diametro, paucis obliquis verticalibusve; cortex inferior 30 μ crassitudine, fastigiatus, gelifactus, luminibus $7 \times 1 \mu$.

Apothecia 5 mm. diametro, subsessilia, margine capitato-soraliato, excipulo minute scrobiculato, rugis subpulverulentis, disco brunneo; cortex amphithecialis 30 μ crassitudine; stratum algarum evanescens; medulla laxa contexta, hyphis periclinalibus 3 μ diametro; stratum algarum sub parathecio 30–50 μ crassitudine, continuum; parathecium 40 μ crassitudine, pseudoparaenchymaticum ex hyphis periclinalibus; hypothecium 10 μ crassitudine, hyphis periclinalibus; thecium 65 μ altitudine; paraphyses tenues, septatae, dichotomae super ascos, ramis submoniliformibus; asci ellipsoideae, 32×13 –14 μ , leptodermei; ascospores octonae, ellipsoideae, 13 –16 \times 7–8 μ , apisorio crasso.

Thallus 13 cm. in diameter, deep olive buff, shading to between olive buff and pale olive buff toward the margins, peripheral lobes rounded, 10 mm. long, 20 mm. wide, crenate, eciliate, somewhat crisped, central lobes suberect, very crisped, with occasional round lobules 1–2 mm. in diameter, margins capitate soraliato, soralia up to 1 mm. in diameter, mostly confluent into a band of coarse granular soredia, about 0.5 mm. wide; underside black, reticulate rugulose, subnitid, with a few stout rhizinae, 1 mm. long, marginal lobes warm brown, central lobes beneath the soredia abruptly warm buff to light buff; upper cortex 10–15 μ thick, of fastigate thin-walled pseudoparenchyma, cells 3–4 μ in diameter, heavily nubilated with brown granules; algal layer of close discrete colonies of *Trebouxia*, 30 μ in diameter, cells 6–7 μ ; medulla K–, C pink above, negative below, KC–, 80 μ thick, on lobules, 160 μ toward center of thallus, of moderately closely woven predominantly longitudinal hyphae about 3 μ in diameter, with a few oblique and vertical hyphae; lower cortex 30 μ thick, fastigate, gelified, lumina 1 μ in diameter, 7 μ long; soredia about 30 μ in diameter.

Apothecia 5 mm. in diameter, nearly sessile, margin closely capitate soraliato, exciple minutely scrobiculate, ridges subpulverulent, disc burnt sienna or darker; amphithecial cortex 30 μ thick above, somewhat thicker below; algae disappearing under the cortex; medulla loosely woven, of mostly periclinal hyphae 3 μ in diameter; algal layer under the parathecium 30–50 μ thick, continuous above, less so below; parathecium 40 μ thick, of periclinal pseudoparenchyma; hypothecium 10 μ thick, of more slender and less closely septate hyphae; thecium 65 μ tall; paraphyses slender, septate, somewhat moniliform above, epithelial gel brownish about 15 μ thick; asci ellipsoid, 8-spored, 32×13 –14 μ , rather thinwalled; ascospores ellipsoid 13 –16 \times 7–8 μ , with a moderately thick episore.

In one apothecium, the thecium has been eaten away, and has regenerated as subspherical immarginate apothecia. Schimper, Iter Abyssinicum, II, no. 1396 is represented by two collections, at Kew, one fertile on which the above description of apothecia has been based, the other of two plants, the larger *P. Allenii* but sterile, the smaller a thallus of *P. hababiana* Gyelnik.

SOMALILAND: Ahlgebirge, 2000 m., on dead *Acacia* branches and twigs, J. M. Hildebrandt 897 p. p. com. C. Rensch, det. *P. urceolata* v. *nuda* by Müller Argau at Farlow Herb., a duplicate at Kew sub *P. olivetorum* (Ach.) Nyl.

ETHIOPIA: Asella, Arussi, 2575 m., rainfall more than 50 inches, H. F. Mooney 5145; Haramat District, near Geraz, on bark of *Euphorbia Colluall*, Schimper, Iter Abyssinicum Sect. II, no. 1396 sub *P. perlata* v. *coniocarpa* Fw., nom. nud. (2 collections); all at Kew.

KENYA: Loita Plains, 60 miles southeast of Narok, 1610–2250 m., Anita Grosvenor Curtis 743, in Dodge Herb.; Lake Ngunga, 1775 m., G. M. Allen 1837, type, in Howe Herb. at Farlow Herb.; Chyulu Hills, H. D. van Someren, fragment in E. African Herb.; northeast side of Mt. Elgon, 2575 m., A. Burnet L29, L30, in Makerere College Herb.

UGANDA: Kigezi, Mafuga, on rocks, 2580 m., I. R. Dale L52, L18 p. p. min.; Naiguru ridge, 2415 m., growing over hepatics on bark, I. R. Dale L49; Bunyoro, Busingoro, 1130 m., on *Poinsettia* bush, I. R. Dale L51a; all at Kew; Kiambu District, Limuru, 2130 m., A. Burnet L6, in Makerere College Herb.

CÔTE D'IVOIRE: Domaine soudano-guinéen, 20 km. north of Bouzke, Guy Roberty 13530, in Conservatoire Bot. Genève.

NORTHERN RHODESIA: Abercorn, A. A. Bullock 1394, International Red Locust Control Service, at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida*, Alice Pegler 1231 p. p. min., at Kew.

PARMELIA (AMPHIGYMNIA) cazengensis Dodge, nom. nov.

Parmelia olivetorum v. *sorediosa* Vainio, Cat. Welwitsch African Pl. 2:399. 1901.

Type: Angola, Cazengo, Serra de Muxaula, Welwitsch 112.

Thallus up to 10 cm. in diameter, deep olive buff, peripheral lobes up to 20 mm. long and wide, margins smooth, crenate, somewhat crisped, central lobes smaller, more crisped with a narrow continuous band of powdery soredia, upper surface minutely reticulate rugulose in the center, smooth toward the margins, not reticulate rimulose, eciliate; underside black in the center shading to snuff brown at the margins, cinnamon buff to pinkish buff in a broad zone below the sorediferous margins; rhizinae short, few, with disciform holdfasts; upper cortex 10–15 μ thick, fastigiate, gelified, hyphae 3 μ in diameter, lumina 1 μ , brownish in the outer 7–10 μ ; algal layer 15 μ thick, of close, discrete colonies of *Trebouxia*, cells 5–6 μ in diameter; medulla K–, C nk throughout, KC–, 60–65 μ thick, of loosely woven, predominantly longitudinal hyphae with occasional vertical hyphae, 3 μ in diameter, slightly nubilated with grayish granules next the algal layer; lower cortex 10 μ thick, gelified, fastigiate, lumina about 1.5 μ in diameter, lengths variable.

Thomas 3223 has the medulla KC pink soon fading; *Meliss* 10 from St. Helena has the medulla KC violascent, while the *Dickson* specimen from St. Helena has the medulla K and KC yellowish.

CONGO: Mt. Kahusi, 2700 m., on twigs, F. L. Hendrickx 4314 p. p. min. in E. African Herb.

UGANDA: Kigezi, Kasatoro forest, 1930–2575 m., corticole, I. R. Dale L39, p. p. min.; Karamoja, Timu forest, 2100 m. on twigs in hilltop forest, A. S. Thomas 3224 p. p. min.; Kabale, 2000 m., on *Hibiscus rosa-sinensis* bush, I. R. Dale L55 p. p. min.; Bugishu, Butandiga, 2415 m., on branches of trees, A. S. Thomas 484 p. p. min. ex Herb. Dept. Agr. Uganda; all at Kew.

TANGANYIKA: Kilimanjaro, Bismarck Hill, 1000 m., corticole, Grote, ex B. L. Inst. Amani 8605, at Kew.

PORTUGUESE EAST AFRICA: Lourenço Marques, on *Citrus sinensis* branches, J. P. Guimarães 26, at Kew.

TRANSSVAAL: near Lydenburg, corticole, F. Wilms 2713 p. p. min. at Kew.

SOUTH AFRICA: Kentani District, 320 m., on *Acacia horrida*, Alice Pegler 1231, upper right, middle and lower left plants, at Kew.

†ST. HELENA: J. C. Melliss 10 p. p. min.; Dickson; both at Kew.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, J. Gossweiler, fragments at Kew.

PARMELIA (AMPHIGYMNIA) *Gossweileri* Dodge, sp. nov.

Type: Angola, Cabinda, Chiloango, J. Gossweiler 8091, com. 1919, at Kew.

Thallus 12 cm. diametro, olivaceo-alutaceus vel pallidior, lobis periphericis 10 mm. longitudine, basi 10 mm. latitudine, superne ad 20 mm., rotundatis, minute rimolosis, marginibus crenatis, eciliatis; lobis centralibus lobulatis, lobulis 0.5×0.5 mm., apicibus capitato-soralatis, soralia 1 mm. diametro, rare soralis non stipitatis subconfluentibus; infra niger, marginibus castaneis, rhizinis rarissimis 1 mm. longitudine; cortex superior 15μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 6μ diametro, leptodermei, granulis griseis nubilatis; stratum algarum 15μ crassitudine, coloniis discretis et cellulis sparsis *Trebouxiae*, $5-6 \mu$ diametro; medulla K-, C-, KC-, 100μ crassitudine, hyphis longitudinalibus compacte intertextis, $5-6 \mu$ diametro, granulis griseis nubilatis; cortex inferior 20μ crassitudine, fastigiatus, brunneus, hyphis pachydermeis.

Apothecia rarissima, substipitata, 3 mm. diametro (immatura) marginibus 1 mm. crassitudine, crenatis, lobulatis, lobulis sphaeroides cum soralis; disco urceolato, concavo, ochraceo-fulvo.

Thallus 12 cm. in diameter, probably larger, olive buff to between tilleul buff and pale olive buff, peripheral lobes 10 mm. long, 10 mm. wide at the base up to 20 mm. wide above, rounded, minutely rimulose, margins deeply crenate, eciliate, surface smooth; central lobes lobulate, lobules 0.5 mm. wide and tall, bearing a subspherical soralium 1 mm. in diameter, more rarely the soralia are not stipitate and subconfluent; underside black in the center, shading to chestnut at the margins, rhizinae very rare, stout, about 1 mm. long; underside of margins of central lobes cream color; upper cortex 15μ thick, of fastigate pseudoparenchyma, cells 6μ in diameter, rather thinwalled, heavily nubilated with grayish granules; algal layer 15μ thick, of discrete colonies and scattered cells of *Trebouxia*, $5-6 \mu$ in diameter; medulla K-, C-, KC-, 100μ thick, of compactly woven, longitudinal hyphae $5-6 \mu$ in diameter, heavily nubilated with grayish granules, especially just under the algal layer and just above the lower cortex; lower cortex 20μ thick, fastigate, brownish, of very thickwalled hyphae.

Apothecia very rare, only two present and immature, substipitate, 3 mm. in diameter, margins 1 mm. thick, deeply crenate, lobulate, the lobules with spheroid soralia, disc urceolate becoming concave, ochraceous tawny.

Gossweiler 8057 has some confluent soralia with a few capitate soralia on the upper surface near the margins. The *Summerhayes* specimen is tentatively referred here. Studied within two months after it was collected, the upper surface is lichen green with occasional short cilia on a few lobes; the rhizinae are in small groups on the underside. *Guimares II*, growing on a small branch, has a rugose center and is smaller, only 4×2 cm.

CÔTE D'IVOIRE: secteur para-litoral, Guy Roberty 13764, 12680, juvenile, in Conservatoire Bot. de Genève.

NORTHERN NIGERIA: Zoria District, 6 miles southeast of Kaciya, growing over mosses among orchid roots on tree trunk, *G. Summerhayes*, at Kew.

ANGOLA: Cabinda, Chiloango, *J. Gossweiler* 6629, 8013, 8136, all sterile, 8091, fertile, type; 80336, two thalli on right, sheet H 326-54, 8057; all at Kew.

SUDAN: Onjiro, Issore, growing over hepatics, 1710 m., *T. T. Chipp* 58, at Kew.

TANGANYIKA: Mulinda forest southeast of Tukuyu (New Langenberg), 900 m., growing over roots of *Rangaenis muscicola*, *A. Stolz* 2577B p. p. min., at Kew.

NORTHERN RHODESIA: Abercorn, growing over roots of *Tridactyle teretifolia* Schltr., on *Brachystegia taxifolia*, *A. A. Bullock* 2105 p. p. min., International Red Locust Control Service, at Kew.

LOURENÇO MARQUES: *J. P. Guimares* 11, at Kew.

PARMELIA (AMPHIGYMNIA) SUBCETRARIOIDES des Abb., Bull. Inst. Franç. Afrique Noire 13:974. 1951.

Type: Guinée Française, Kankan, on mango, *des Abbayes*.

Thallus up to 10 cm. in diameter, deep olive buff or a little darker, lobes rounded, 8-10 mm. wide, rounded, very crisped and ascending in the center, appressed at the margins, entire or slightly lobulate, eciliate, central lobes capitate sorediate at first, soon confluent into a broad white band; underside black, shading to dark chestnut at the margins, more or less rugulose, rhizinae short, stout, scattered; upper cortex 20 μ thick, of fastigate pseudoparenchyma, cells 5-6 μ in diameter, moderately thinwalled, very heavily nubilated with hyaline granules; algal layer 30 μ thick, continuous, cells 6-7 μ in diameter; medulla K-, C-, KC-, 135 μ thick, of predominantly longitudinal, closely woven hyphae 3 μ in diameter, with a few oblique or vertical hyphae, very heavily nubilated with brownish granules; lower cortex 15 μ thick, of fastigate pseudoparenchyma, cells 2.5 μ in diameter with very thick, dark brown walls.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, south of Boka de Titi-ékro, *Guy Roberty* 12673 p. p. min., at Conservatoire Bot. Genève.

PARMELIA (AMPHIGYMNIA) OLIVETOROIDES Dodge, sp. nov.

Type: Cape of Good Hope, without locality or collector, in Tuckerman Herb. sub *P. olivetorum*, at Farlow Herb.

Thallus ad 10 cm. diametro, olivaceo-alutaceus, lobis periphericis 15 mm. longitudine latitudineque, rotundatis, marginibus eciliatis, subcrenatis, non crispatis; lobis centralibus minoribus adscendentibus, crispatis, marginibus confluentibus sorediosis pulverulentis; inferne reticulatim rugulosus, centro niger, marginibus brunneis; cortex superior 7 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis 3.5 μ diametro, granulis brunneis nubilatis; stratum algarum 20-25 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 6-7 μ diametro; medulla K-, C-, KC-, 50-55 μ crassitudine, hyphis longitudinalibus laxissime contextis, paucis cum hyphis verticalibus, non nubilatis; cortex inferior 7 μ crassitudine, pseudoparenchymaticus ex hyphis longitudinalibus. Apothecia non visa.

Thallus up to 10 cm. in diameter, deep olive buff, peripheral lobes flat, 15 mm. long and wide, round, margins eciliate, slightly crenate, central lobes smaller, ascending, slightly crenate, crisped, margins completely powdery sorediose in a band 0.2-0.3 mm. wide; underside reticulate rugulose, black in the center shading to buckthorn brown on the margins or a broad band of buff yellow on lobes with

sorediate margins; rhizinae not seen as central portions are glued to the herbarium sheet; upper cortex $7\ \mu$ thick, of fastigate pseudoparenchyma, cells thinwalled, $3.5\ \mu$ in diameter, heavily nubilated with brownish granules; algal layer $20\text{--}25\ \mu$ thick, subcontinuous, of discrete colonies of *Trebouxia*, cells $6\text{--}7\ \mu$ in diameter; with relatively large air spaces between algal cells; medulla K-, C-, KC-, $50\text{--}55\ \mu$ thick, of very loosely woven, longitudinal hyphae, with some vertical hyphae uniting the two cortices, not nubilated; lower cortex $7\ \mu$ thick, apparently of pseudoparenchyma from two layers of longitudinal hyphae in a pale brownish gel. Apothecia not seen.

CAPE OF GOOD HOPE: without locality or collector, in Tuckerman Herb. sub *P. olivetorum*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) GLAUCOCARPOIDES Zahlbr., Cat. Lich. Univ. 6:167. 1929.

Parmelia glaucocarpa Müll. Arg., Flora 67:615. 1884, non Ach.

Type: Madagascar, Nossi Be, ramulicole, J. M. Hildebrandt, Nov. 1880, portion of type collection ex herb. Sbarbaro, at Farlow Herb.

Thallus investing twigs, 9 cm. long, 4 cm. wide, between cream buff and olive buff (1957), lobes rounded, 10 mm. long, 15 mm. wide, margins coarsely dentate to lobulate, lobules up to 5 mm. wide and long, margins revolute, appearing crenulate, sometimes deeply crenate, almost digitate, surface smooth to slightly rugose or coarsely undulate and somewhat crisped, all margins ciliate, cilia up to 2 mm. long; under side black in the center, rarely almost to the margin, usually abruptly cinnamon to Sayal brown, reticulate rugulose; rhizinae dense in the center, about 10 mm. long, tips branched where in contact with the twig; upper cortex $10\text{--}12\ \mu$ thick, of fastigate, thinwalled pseudoparenchyma, cells $4\text{--}5\ \mu$ in diameter, slightly nubilated with hyaline granules; algal layer of widely spaced colonies of *Trebouxia*, $15\ \mu$ in diameter, cells $7\ \mu$ in diameter; medulla K-, C-, KC-, $30\ \mu$ thick, upper third of closely woven longitudinal hyphae, the rest of more loosely woven, mostly oblique hyphae $3\text{--}4\ \mu$ in diameter, not nubilated; lower cortex $5\text{--}6\ \mu$ thick, a single layer of very thickwalled longitudinal hyphae, protoplasts spherical, $1\ \mu$ in diameter.

Apothecia $5\text{--}7$ mm. in diameter, stipitate, stipe hollow, about 3 mm. tall, 2 mm. in diameter, smooth, becoming somewhat longitudinally rugose; margin entire to minutely crenulate, exciple smooth, minutely white punctate and subreticulate but not pseudocyphellate, sometimes rugose near the stipe; disc deeply concave becoming flattened, somewhat pruinose, finally nude and buckthorn brown, perforate, hole 1 (–2) mm. in diameter, sometimes splitting to the margin of the perforation; amphithecial cortex $50\text{--}85\ \mu$ thick, fastigate, gelified, nubilated in the outer $15\ \mu$ with brownish granules; algal colonies $15\text{--}30\ \mu$ in diameter, widely spaced, some pushing up into the amphithecial cortex in columns $50 \times 15\ \mu$, cells $6\text{--}7\ \mu$ in diameter; medulla of periclinal, loosely woven hyphae; algal layer under the parathecium of discrete colonies $30\ \mu$ in diameter; parathecium $15\ \mu$ thick, fastigate, gelified; hypothecium $20\ \mu$ thick, of closely woven slender hyphae; thecium $85\text{--}90\ \mu$ tall; paraphyses slender, septate, simple or dichotomous above the

asci, branches moniliform above, terminal cells subspherical, $5\ \mu$ in diameter, thick-walled, apparently cut off to form the pruina, epithelial gel brownish to a depth of $10\ \mu$, nubilated with brownish granules; asci broadly ellipsoidal, $45 \times 30\ \mu$, wall $3\ \mu$ thick, tip not thicker, 8-spored; ascospores ellipsoidal, $23-28 \times 12-14\ \mu$, episporium about $2\ \mu$ thick.

Hildebrandt, July 1875 has the lobes more sparsely ciliate, many nude, lobules up to 8 mm. long, digitately or coralloid branched margins revolute and deeply canaliculate below.

MADAGASCAR: Nossi Be, ramulicole, J. M. *Hildebrandt*, Nov. 1880, type collection; Berari, ramulicole, J. M. *Hildebrandt*, July 1875; Imerina, Andrangolaoka, 1200 m., saxicole, J. M. *Hildebrandt* 2172a, fragments growing with *Usnea pulvinata* Fr.; ramulicole, J. M. *Hildebrandt*, July 1875 sub *P. latissima* v. *corniculata* Krmphbr.; all ex herb. Sbarbaro, at Farlow Herb.

PARMELIA (AMPHIGYNIA) nigeriensis Dodge, sp. nov.

Type: Nigeria, Plateau Province, Panshin, Mongu Forest Reserve, north of road between Mongu and Gindiri, near mile 4 in open woodland savannah, corticole, D. E. S. Keay & R. W. J. King 37096, ex Forest Herb. Ibadan, at Kew.

Thallus 8×5 cm., griseo-olivaceus, lobis periphericis rotundatis, 10 mm. longitudine latitudineque, marginibus crispatis, dense ciliatis, cilia $1.5-2$ mm. longitudine, lobulis ad 1 mm. longitudine, 0.2 mm. latitudine, lobis centralibus minoribus lobulatisque, lobulis variabilibus; inferne niger, rhizinosus, lobis periphericis alutaceis, reticulatim rugulosus; cortex superior $15\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, hyphis $5-6\ \mu$ diametro, protoplastis sphaericis, $1\ \mu$ diametro, granulis brunneis nubilatis; stratum algarum $18\ \mu$ crassitudine, coloniis discretis, *Trebouxiae*, cellulis $5\ \mu$ diametro; medulla K-, C-, KC-, $80\ \mu$ crassitudine, hyphis pachydermeis longitudinalibus, dense contextis; cortex inferior nigro-brunneus, $15\ \mu$ crassitudine, hyphis longitudinalibus, cellulis isodiametricis, $6\ \mu$ diametro.

Apothecia $14-15$ mm. diametro, stipitata, stipitibus 2 mm. diametro, 5 mm. altitudine, laevibus aut longitudinaliter subrugulosis, margine dentato lobulatoque, ciliato; excipulo reticulatim ruguloso vel scrobiculato, disco perforato, concavo applanato, brunneo; cortex amphithecialis $80\ \mu$ crassitudine, fastigiatus, hyphis $6\ \mu$ diametro, septatis luminibus ca. $1\ \mu$ diametro, parte externa granulis brunneis nubilata; stratum algarum $45-55\ \mu$ crassitudine, continuum; medulla subarchoidea; stratum algarum sub parathecio $30\ \mu$ crassitudine, subcontinuum; parathecium $30\ \mu$ crassitudine, hyphis periclinalibus, cellulis isodiametricis; hypothecium hyphis periclinalibus ab parathecio non bene distinctum; thecium $80\ \mu$ altitudine; paraphyses tenues, septatae, multoties dichotomae super ascos, superne nubilatae; asci clavati, $65 \times 15\ \mu$, apicibus juventute incrassatae; ascospores quaternae octonae, ellipsoideae, $16-19 \times 11\ \mu$ episporio crasso.

Thallus 8×5 cm., grayish olive, peripheral lobes rounded, 10 mm. long and wide, margins crisped, closely ciliate, cilia $1.5-2$ mm. long, occasionally lobulate, lobules up to 1 mm. long, 0.2 mm. wide, surface smooth, opaque; central lobes somewhat smaller, more closely lobulate, lobules variable in size and shape; underside black in the center, shading to warm buff or cinnamon buff on the margins of the peripheral lobes, reticulate rugulose, nude, center with rather dense long

rhizinae; upper cortex 15 μ thick, of fastigate pseudoparenchyma, hyphae 5–6 μ in diameter, protoplasts spherical about 1 μ in diameter, nubilated with brownish granules; algal layer 18 μ thick of discrete colonies of *Trebouxia* in a nearly continuous layer, a few cells deeper in the medulla, cells 5 μ in diameter; medulla K–, C–, KC–, 80 μ thick, of very closely woven longitudinal thickwalled hyphae 6 μ in diameter, not nubilated; lower cortex dark brown, 15 μ thick, of pseudoparenchyma from longitudinal hyphae, cells 6 μ in diameter.

Apothecia abundant, 14–15 mm. in diameter, stipes 5 mm. tall, 2 mm. in diameter, smooth or slightly longitudinal rugulose; margin dentate to closely lobulate and ciliate, exciple reticulate rugulose to shallowly scrobiculate; disc perforate, concave to flattened, argus brown; amphithecial cortex 80 μ thick, fastigate, hyphae 6 μ in diameter, lumina about 1 μ , septate but not closely so, outer 20 μ heavily nubilated with brownish granules; algal layer 40–50 μ thick, nearly continuous, in places columns of algal cells pushing up between the cortical hyphae for 50 μ ; medulla loosely woven below to almost arachnoid above; algal layer under the parathecium 30 μ thick, of discrete colonies; parathecium 30 μ thick, pseudoparenchymatous from periclinal hyphae; hypothecium scarcely differentiated from the parathecium but hyphae with thinner walls; thecium 80 μ tall; paraphyses slender, septate, several times dichotomous above the asci, heavily nubilated in the upper 10 μ ; asci clavate, 65 \times 15 μ , tips thickened when young, 4–8-spored; ascospores 16–19 \times 11 μ , ellipsoid, with thick episore.

Holland 59 is doubtfully referred here. It is sterile, the thallus is larger and paler, the central lobules somewhat smaller. Perhaps it is an ecologic variant coming from a much lower elevation.

NIGERIA: Plateau Province, Pankshin, Mongu Forest Reserve, north of road between Mongu and Gindiri, near mile 4 in open woodland savannah, corticole, D. E. S. Keay & R. W. J. King 37096 ex Forest Herb. Ibadan; Old Calabar, Consulate Hill, corticole, J. H. Holland 59; both at Kew.

PARMELIA (AMPHIGYMNIA) EURYCARPA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:530. 1926.

Type: Tanganyika, East Usambara, Amani, 800 m., corticole, *Brunnthaler*.

Thallus up to 12 cm. in diameter, between vinaceous buff and olive buff (1957), peripheral lobes 25 mm. long, 20 mm. wide, rounded, narrowly black margined, slightly crenate, cilia up to 4 mm. long, central lobes more deeply crenate and lobulate, lobules 1–3 mm. long, 0.5–1 mm. wide, tips truncate, rarely retuse, occasionally di- or trichotomous, 1–2 ciliate; surface slightly impressed, slightly rimulose in the older portions; underside black, reticulate rugulose, subnitid, margins auburn or darker, smooth, shining; rhizinae few in small groups, up to 2 mm. long, resembling the cilia unless making contact with the substrate, then shorter, stouter, forming a disciform holdfast 0.5 mm. in diameter; upper cortex 15 μ thick, of fastigate pseudoparenchyma, hyphae moniliform, cells 6–7 μ in diameter, lumina 2 μ , heavily nubilated with brownish granules; algal layer 15 μ thick, of widely spaced colonies of *Trebouxia*, cells 6–7 μ in diameter, nubilated with brownish granules; medulla K yellow, unevenly rufescent, C–, KC–, 65 μ thick, of moderately closely woven longitudinal hyphae, nubilated with brownish

granules, with occasional air spaces under the algal layer, up to half the thickness of the medulla, crossed by some vertical hyphae $3\ \mu$ in diameter, only slightly nubilated; lower cortex black, 12–13 μ thick, of longitudinal thickwalled hyphae, very dark brown, cells 4–5 μ in diameter.

Apothecia cupuliform, up to 20 mm. in diameter, stipe 2 mm. tall, 4 mm. in diameter, longitudinally rugose; margin incurved, smooth, exciple minutely scrobiculate, disc imperforate, cinnamon brown; amphithecial cortex 20–25 μ thick, gelified, fastigate, of rather thinwalled pseudoparenchyma, interrupted by air passages to the algal layer and occasionally algal cells pushing up to the surface; algal layer 40 μ thick, continuous, cells closely packed above, more scattered next the medulla; algal layer under the parathecium 30 μ thick, of close colonies, heavily nubilated with brownish granules above; parathecium 15–20 μ thick, of fastigate pseudoparenchyma; hypothecium 15 μ thick, of slender periclinal hyphae, the lower half very closely woven, the upper half loosely woven; thecium 55 μ tall; paraphyses slender, septate, tips not thickened, ending about 8 μ below the surface of the brownish epithelial gel; asci cylindric clavate, $65 \times 18\ \mu$, wall 3–4 μ thick, tip thicker, 8-spored; ascospores monostichous at first becoming distichous, ellipsoidal, $19\text{--}29 \times 11.5\text{--}18\ \mu$.

Bullock 1871 pars is fertile but the ascospores are apparently not quite mature, reaching only the minimum dimensions given in the original description. The Kenya specimen is sterile, the cilia are somewhat longer and the medulla is K slightly yellowish, not unevenly orange rufescent. Since it was growing on humus among rocks in the forest, the near absence of the K reaction may be due to shade.

KENYA: Wandangi Hill, on decaying vegetable debris among rocks in forest, *Goanna* (native collector) ex herb. E. African Agr. Res. Sta. 8974, in E. African Herb.

TANGANYIKA: Ifipa, Malonje, 2575 m., growing over roots of *Aerangis* on *Ochna* sp., A. A. Bullock 1871 pars, International Red Locust Control Service, at Kew.

NYASALAND: Kota-Kota District, Mt. Nchisi, 1400 m., on dead branch of *Brachystegia*, L. J. Brass 17622, 16918, immature, both in Dodge Herb.

PARMELIA (AMPHIGYMNIA) amboimensis Dodge, sp. nov.

Type: Angola, Cuanza Sul, Amboim, Capir near Carloaongo-Cuvo River, 1000 m., corticole, J. Gossweiler 9993, at Kew.

Thallus 10 cm. diametro, dilute olivaceo-alutaceus, lobis irregulariter dichotomis, 5 mm. latitudine, marginibus revolutis, ciliatis, ciliis tenuibus, 1–3 mm. longitudine, lobulis ultimis variabilibus, aliis 1 mm. latitudine, apicibus rotundatis, truncatis retusive, alteris magis rotundatis, 5 mm. diametro, lobulis brevibus truncatis, sinibus rotundatis; infra niger, centro reticulatim rugosus, marginibus laevibus, rhizinis 2–3 mm. longitudine, simplicibus furcatisve; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis leptodermeis, 4–5 μ diametro, granulis brunneis nubilatis; stratum algarum coloniis discretis *Trebouxiae*, 15 μ diametro, cellulis sparsis 6 μ diametro; medulla K–, C roseo, KC rubra, 30 μ crassitudine, hyphis longitudinalibus 3 μ diametro; cortex inferior niger, 7 μ crassitudine, pseudoparenchymaticus ex hyphis longitudinalibus.

Apothecia ad 10 mm. diametro, urceolata, stipite 4–5 mm. altitudine, 4 mm. diametro, laevis, longitudinaliter rugosus sub excipulo; margine integro, inflexo,

excipulo laevi dein impresso-punctato aut minute scrobiculato; disco rufo-brunneo, imperforato; cortex amphithecialis $25\ \mu$ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum $30\ \mu$ crassitudine, coloniis discretis et cellulis singulis sparsis; stratum algarum sub parathecio $25\ \mu$ crassitudine, subcontinuum, coloniis discretis; parathecium $13\text{--}15\ \mu$ crassitudine, gelifactum, pseudoparenchymatice fastigiatum; hypothecium $10\ \mu$ crassitudine, hyphis tenuibus compacte intertextis; thecium $50\ \mu$ altitudine; paraphyses tenues, septatae, super ascos dichotomae, apicibus non incrassatis; asci clavati, $44 \times 15\ \mu$, pachydermei, apicibus incrassatis, ascosporae octonae, late ellipsoideae, $10\text{--}13 \times 7\ \mu$, episporio crasso.

Thallus 10 cm. in diameter, pale olive buff, lobes irregularly dichotomous, about 5 mm. wide below, margins revolute, ciliate, cilia slender, 1–3 mm. long, ultimate lobules variable, 1 mm. wide, tips rounded, truncate or retuse, others more rounded, 5 mm. in diameter with short truncate lobules and rounded sinuses; underside black, reticulate rugose, smooth near the margins; rhizinae single or in small groups in the center of the lobes, simple or forked, 2–3 mm. long, resembling cilia, those in the center of the thallus short, stout, forming disciform holdfasts; upper cortex $20\ \mu$ thick, of fastigiate thinwalled pseudoparenchyma, cells $4\text{--}5\ \mu$ in diameter, heavily nubilated with brownish granules in the outer $15\ \mu$; algal layer of discrete colonies of *Trebouxia*, $15\ \mu$ in diameter and scattered cells $6\ \mu$ in diameter; medulla K-, C pink, KC a deeper pink, $30\ \mu$ thick of moderately closely woven longitudinal hyphae $3\ \mu$ in diameter, sending vertical branches up between the algal cells and colonies to the upper cortex; lower cortex gelified, black, $7\ \mu$ thick, pseudoparenchymatous from longitudinal hyphae.

Apothecia 10 (–15) mm. in diameter, deeply urceolate at first, stipe 4–5 mm. tall, 4 mm. in diameter, smooth, slightly longitudinally rugose at the base of the exciple; margin entire, inrolled at first, exciple smooth, becoming impressed punctate to minutely scrobiculate; disc auburn or darker, long imperforate, finally perforate; amphithecial cortex $25\ \mu$ thick, of fastigiate thinwalled pseudoparenchyma; algal layer $30\ \mu$ thick, of scattered colonies and single cells; algal layer under the parathecium $25\ \mu$ thick, of discrete colonies forming a nearly continuous layer; parathecium $13\text{--}15\ \mu$ thick, of fastigiate gelified pseudoparenchyma; hypothecium $10\ \mu$ thick, of slender, very closely woven hyphae; thecium $50\ \mu$ tall; paraphyses slender, septate, dichotomous above the asci, tips not thickened, ending about $3\ \mu$ below the surface of the dark brown epithecial gel; asci clavate, $45 \times 15\ \mu$, wall $3\ \mu$ thick, tips $6\ \mu$; ascospores broadly ellipsoidal, $10\text{--}13 \times 7\ \mu$, with a moderately thick episporium.

CAMEROON: between Jaunde and Dengdeng, south of the Sanaga River near the confluence of Lom (Sanaga) and Djerem rivers, about 165 km. northeast of Jaunde, *J. Milbraed* III, 8403, at Kew.

ANGOLA: Cuanza Sul, Amboim, Capir near the Carloaongo-Cuvo River, 1000 m., corticole, *J. Gossweiler* 9907, 9993, type; Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler* com. 1910; Cazengo, Granja Sao Luiz, on dead twigs in dense forest, *H. H. W. Pearson* 2327 p. p. min., Percy Sladen Mem. Exp. to South West Africa; all at Kew.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small* 217 p. p. min.; Kigezi, Mafuga, 2415 m., corticole, *I. R. Dale* L50 p. p. min.; both at Kew.

PARMELIA (AMPHIGYMNIA) PROCERA Steiner & Zahlbr., Bot. Jahrb. [Engler] 60: 537. 1926.

Type: Tanganyika, East Usambara, Amani, 800 m., *Brunnthaler, Schroeder 187*.

Thallus 10–15 cm. in diameter, tea green, peripheral lobes 15 mm. wide, rounded, margins very crisped, shallowly crenate, ciliate, cilia slender, 2–3 mm. long, central lobes with lobulate margins, lobules 1–1.5 (–2) mm. long, sublinear, margins revolute, tips somewhat crisped and crenulate, ascending, sparingly ciliate; upper surface smooth, subnitid, not rimulose; underside black in the center, slightly rugulose, opaque, margins of peripheral lobes russet to tawny, smooth and shining; rhizinae few, stout, short, tips branching to form a holdfast when in contact with the substrate; upper cortex 12 μ thick, of fastigate pseudoparenchyma, cells 3 μ in diameter, lumina 1 μ , heavily nubilated with subhyaline granules; algal layer 15–20 μ thick, continuous, cells 6–7 μ in diameter, tending to be arranged in vertical rows; medulla K black, C–, KC–, (K–, KC reddening in original description), 65 μ thick, of predominantly longitudinal hyphae 3 μ in diameter with many vartical hyphae connecting the cortices, moderately closely woven, somewhat looser with more vertical hyphae just under the algal layer; lower cortex 12–15 μ thick, of fastigate gelified pseudoparenchyma, lumina about 1 μ in diameter, deep brown in section, not nubilated.

Apothecia urceolate at first then cupulate, finally plane and floriform by splitting into lobes and the margins healing, 20–30 mm. in diameter, stipes 7 mm. tall, 4 mm. in diameter; margin crenulate, inrolled, exciple smooth to faintly and minutely impressed in older apothecia, subnitid; disc russet darkening; amphithecial cortex 30–35 μ thick, of fastigate gelified pseudoparenchyma heavily nubilated with brownish granules; algal layer 30 μ thick, of close discrete colonies of *Trebouxia*, cells 6–7 μ in diameter; algal layer under the parathecium 30 μ thick, continuous; parathecium 15 μ thick, of gelified periclinal pseudoparenchyma, protoplasts $3-4 \times 2 \mu$; hypothecium 15 μ thick, of slender, closely woven periclinal hyphae; thecium 40 μ tall; paraphyses slender, septate, dichotomous above the asci, tips slightly clavate reaching the surface of the brownish epithelial gel; asci ellipsoid, 8-spored, $45 \times 16 \mu$, wall 3 μ thick, tip slightly thicker; ascospores elongate ellipsoid, $13-17 \times 5.5-7 \mu$, showing a curious bipolar staining when still in the ascus, and falsely 2-celled when free.

Spermogonia 120–140 μ in diameter; wall dark brown; spermatia $4.5-7 \times 0.7-0.8 \mu$, fide Steiner & Zahlbr., l.c.

TANGANYIKA: East Usambara, Amani, 1000 m., on trees in rain forest, *P. J. Greenway 1001*, in East African Herb.

CONGO: km. 30, route Kahusi, *F. L. Hendrickx 4330*, young and sterile, in E. African Herb.

PARMELIA (AMPHIGYMNIA) *aldabrensis* Dodge, sp. nov.

Type: Aldabra Islands, on tamarind, *Walter Fox 220*, com. *P. R. Dupont*, at Kew.

Thallus 14 cm. diametro, olivaceo-alutaceus, lobis periphericis radiantibus, imbricatis, 40 mm. longitudine, 10 mm. latitudine, lateribus crenatis, marginibus

lobulatis, lobulis ca. 1 mm. longitudine, 0.5–1 mm. latitudine, apicibus rotundatis, crenulatisque; lobulis centralibus magis rotundatis, substipitatisque; superficie laevi dein impresso-punctato, centro minute subrugosa; inferne niger, marginibus brunneis nudis; rhizinae 1 mm. longitudine; cortex superior 10 μ crassitudine, pseudoparenchymatice fastigiatus, granulis brunneis dense nubilatus; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K flavescens, C–, KC–, 65 μ crassitudine, hyphis longitudinalibus, 3 μ diametro, dense contextis, granulis griseis nubilatis; cortex inferior 5–6 μ crassitudine, pseudoparenchymaticus, cellulis 2.5–3 μ diametro.

Apothecia urceolata, ad 3 mm. diametro, stipite 1 mm. altitudine, margine integro, excipulo minute alboreticulato, subruguloso; disco electrino-brunneo, perforato; cortex amphithecialis 60 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis pachydermeis, strato amorpha 5 μ crassitudine tectus; stratum algarum 30–40 μ crassitudine, subcontinuum, cellulis 6–7 μ diametro; medulla granulis griseis dense nubilata; stratum algarum sub parathecio 30 μ crassitudine, coloniis discretis; parathecium 25 μ crassitudine, hyphis septatis periclinalibus conglutinatis, luminibus 2.5 μ diametro; hypothecium non bene distinctum; thecium 60 μ altitudine; paraphyses tenues, dichotomae, ramis ultimis submoniliformibus apicibus non incrassatis; asci clavati, 40 \times 16 μ , apicibus juventute incrassatis; ascospores octonae, ellipsoideae, 13–16 \times 5–6 μ episporio tenui.

Thallus 14 cm. in diameter, between deep olive buff and olive buff, peripheral lobes radial, imbricate, 40 mm. long, 10 mm. wide, deeply crenate on sides, margins lobulate, lobules 0.5–1 mm. wide, 1 mm. long, cilia 1–1.5 (–2) mm. long, tips of lobes more rounded, crenulate, central lobules about 1 mm. in diameter, more rounded and substipitate; surface smooth becoming impressed punctate and minutely subrugose near the center; underside black with Brussels brown margins, rhizinae in scattered groups, about 1 mm. long, tips acute unless making contact with the substrate, where they form holdfasts about 0.5 mm. in diameter; upper cortex 10 μ thick, of fastigate pseudoparenchyma, very heavily nubilated with brownish granules; algal layer 15 μ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells 5–6 μ in diameter; medulla K yellow, C–, KC–, 65 μ thick, of closely woven longitudinal hyphae, 3 μ in diameter, heavily nubilated with grayish granules; lower cortex 5–6 μ thick, pseudoparenchymatous, about 2 cells thick.

Apothecia up to 5 mm. in diameter, stipe 1 mm. tall, 1 mm. in diameter, margin smooth, exciple minutely white reticulate, slightly rugulose, disc concave, amber brown, finally perforate; amphithecial cortex 60 μ thick, of fastigate pseudoparenchyma, very thickwalled, outer 5 μ amorphous; algal layer 30–40 μ thick, nearly continuous, cells 6–7 μ in diameter; medulla dense, heavily nubilated with grayish granules; algal layer under the parathecium about 30 μ thick, less continuous than under the amphithecial cortex; parathecium 25 μ thick, of septate, conglutinate periclinal hyphae, lumina 2.5 μ in diameter; hypothecium not well differentiated; thecium 65 μ tall; paraphyses slender, dichotomous about the middle and once or twice above, the ultimate branches submoniliform, tips not thickened nearly reaching the surface of the pale brownish epithelial gel; asci clavate, 8–

spored, $40 \times 16 \mu$, tips thickened when young, protoplast short mamillate; ascospores ellipsoid, $13-16 \times 5-6 \mu$, with a thin episore.

ALDABRA ISLANDS: on tamarind, *Walter Fox 220*, com. F. R. Dupont, type, at Kew.

PARMELIA (AMPHIGYMNIA) subbullata (Steiner & Zahlbr.) Dodge, comb. nov.

Parmelia pedicellata v. *subbullata* Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:536. 1926.

Type: Tanganyika, Bukoba, near Lake Victoria Nyanza, *Schroeder 323*; Kenya, Kikuyu near Nairobi, *Horn*; neither designated as type.

Thallus up to 10 cm. in diameter, from buffy brown to avellaneous and from deep olive buff to olive buff, peripheral lobes 30 mm. long, 7-10 mm. wide below expanding to 30 mm. above, irregularly divided by deep sinuses into 3-5 rounded lobes about 10 mm. in diameter, margins smooth or shallowly crenulate, coarsely crisped, cilia about 0.5 mm. long, occasionally lobulate (as a result of regeneration following injury or insect damage), lobules rounded conchiform, about 1 mm. in diameter; upper surface closely rugulose in the center, subbullate, marginal lobes smooth to slightly impressed; underside black in the center, opaque, reticulate rugulose shading to warm sepia to Verona brown at the smooth margins; rhizinae in small groups, short, stout, ending in deeply branched tips, forming more or less confluent holdfasts on the surface of the bark; upper cortex about 12μ thick, of fastigate pseudoparenchyma, cells 4μ in diameter, the upper 2 cells heavily nubilated with brownish granules; algal layer up to 30μ thick, of discrete colonies of *Trebouxia*, about 15μ in diameter with scattered cells below, cells mostly 5-7 μ in diameter; medulla K-, C faint pink, KC-, 65μ thick, of loosely woven strands of longitudinal hyphae 3μ in diameter with some vertical hyphae and moderate air spaces; lower cortex about 15μ thick thinning to 7-8 μ at the margin, of fastigate pseudoparenchyma, cells somewhat irregularly arranged, lumina about 1μ in diameter.

Apothecia in the center of the thallus, 10 (-15) mm. in diameter, urceolate with inrolled entire margin at first, long cupulate, finally splitting and irregularly flattened, short stipitate, margin slightly crenate; exciple minutely reticulate rugose and subscrobiculate, not cracking along the ridges, disc widely perforate, auburn, regenerating the amphithecial cortex, where the thecium is eaten away by insects; amphithecial cortex 50μ thick, of fastigate pseudoparenchyma, hyphae 3μ in diameter, protoplasts 2μ , nubilated in the outer half; algal layer 30-50 μ thick, of close, discrete colonies in a nearly continuous layer, (upper surface crenate in section); medulla loosely woven; algal layer under the parathecium 30μ thick, closely packed above, more loosely so below in a continuous layer (upper surface crenate in section); parathecium about 15μ thick between the algal colonies, only 7-8 μ above them, hyaline, fastigate, protoplasts spherical, 2.5-3 μ in diameter, becoming periclinal next the hypothecium; hypothecium 30μ thick, of moderately closely woven slender periclinal hyphae, deeply staining; thecium 75μ tall; paraphyses slender, septate, often dichotomous above the asci, tips clavate, ending in the brownish epithelial gel, sometimes reaching the surface; asci, clavate, thin-walled, $50 \times 15 \mu$, tip 3μ thick, 8-spored; ascospores ellipsoidal, $10-15 \times 7-9 \mu$.

Since my sections are taken from the margin of the lobe and perpendicular to

it in all cases, the dimensions are smaller than those reported in the original description, but they agree anatomically. The medullar reaction with C is less intense than that called for in the original description.

KENYA: Northern Frontier Province, Moyale, $3^{\circ} 32' N.$, $39^{\circ} 03' E.$, 1255 m., on old trees, J. B. Gillett 12918, very immature, at Kew.

UGANDA: E. Tropical Africa between 2° and $7^{\circ} S.$, James Hannington, immature; Bunyiro, Busingoro, 1130 m., on bark of old *Jacaranda* tree, I. R. Dale L54, L68; all at Kew.

TANGANYIKA: Nkunde-Chapota, 2250 m., growing over roots of *Diaphanathe pulchella* Summerh. on branch of *Acacia*, 20 ft. from ground, in dense shade, A. A. Bullock 1962 pars, International Red Locust Control Service, at Kew.

NYASALAND: Nyika Plateau, 2340 m., on tree branches, L. J. Brass 17214, Vernay Nyasaland Exp., sterile, juvenile, in Dodge Herb.

PARMELIA (AMPHIGYMNIA) ABESSINICA Nyl. in Krmph., Linnaea 41:140. 1877.

Parmelia abyssinica Nyl., Flora 68:608. 1885.

Type: Ethiopia, Maeshalit, J. M. Hildebrandt; Habab, 1610 m., J. M. Hildebrandt 314!

Thallus 4–5 cm. in diameter, K yellow, citrine drab to cream buff and chamois in older portions near apothecia, lobes rounded, 10 mm. or more wide, margins ascending, flexuous and coarsely crisped, with scattered black cilia, crenulate to fimbriate lobulate from splitting in the angles, surface rugulose, smooth toward the margins; underside black, minutely reticulate rugose with a few coarse rhizinae near the center of the lobes, 2–3 mm. long, margins sometimes black, often cream buff or lighter; upper cortex $10\ \mu$ thick, of fastigate pseudoparenchyma, highly gelified; algal layer up to $30\ \mu$ thick, of discrete but nearly continuous colonies of *Trebouxia*, cells $6\ \mu$ in diameter; medulla K–, C–, KC–, $80\ \mu$ thick, of predominantly longitudinal hyphae, $4\ \mu$ in diameter, very thickwalled, the upper third under the algal layer more loosely woven with air spaces; lower cortex $10\ \mu$ thick, of very thickwalled pale brown cells, mostly spherical and irregularly packed, with a tendency to fastigate arrangement, 5–6 μ in diameter.

Apothecia 7–8 mm. in diameter, stipes 4 mm. tall, 2.5 mm. in diameter, longitudinally deeply rugose and subscrobiculate, margin deeply crenulate, inrolled at first; exciple infundibuliform, cream buff to chamois, smooth at first becoming reticulately rugose and subscrobiculate; disc deeply concave and imperforate becoming nearly plane and perforate, auburn; amphithecial cortex $16\ \mu$ thick, of fastigate pseudoparenchyma, gelified, outer gel brownish; algal layer $65\ \mu$ thick, of discrete colonies with occasional cells in the medulla; algal layer under the parathecium $20\ \mu$ thick, nearly continuous; parathecium $30\ \mu$ thick, of pseudoparenchyma from periclinial hyphae $4\ \mu$ in diameter; hypothecium $20\ \mu$ thick, of slender more loosely woven hyphae; thecium $65\ \mu$ tall; paraphyses slender, simple or once dichotomous above the asci, tips not thickened, ending in the brownish epithelial gel; asci ellipsoid, $45 \times 20\ \mu$, wall and tip thickened, 8-spored; ascospores distichous, ellipsoid, $16\text{--}17 \times 6\text{--}7\ \mu$, with thick epispore.

Spermogonia abundant in the outer portions of the lobes, oblatly spheroidal, $160\ \mu$ tall, $210\ \mu$ in diameter; wall blackened about the ostiole, 9–10 μ thick, of brownish very small celled periclinial pseudoparenchyma; spermatiophores $60\ \mu$

long, septate; spermatia lateral at the septa, bacilliform, about $6 \times 0.6 \mu$.

Small J19 has somewhat smaller lobes and broader ascospores, $16 \times 8-10 \mu$.

ETHIOPIA: Chokke Mts. $10^{\circ} 40' N.$, $37^{\circ} 45' E.$, north of Debra Marcos, *J. N. Lythgoe* 34, C.B.E.E.; *W. J. Ballantine* 73 p. p. min., C.B.E.E.; both at Kew.

KENYA: Chyulu Hills, *H. D. van Someren*, in *E. African Herb.*; Guaso Nyiro, *G. M. Allen* 1831b, in *Dodge Herb.*

UGANDA: Mt. Elgon, 1290 m., *W. Small J19* p. p.; Kigezi, saddle between Muhuvura and Mgahinga, on trees, *I. R. Dale* 11b, fragments; both at Kew.

CONGO: Kahusi, on *Arundinaria alpina*, *F. L. Hendrickx* 4302b, 4305 p. p. min., sterile, in *E. African Herb.*

forma GLABRIOR Steiner & Zahlbr., *Bot. Jahrb. [Engler]* 60:526. 1926.

Type: Tanganyika, West Usambara, between Mazumbai and Mzingu, 1100-1200 m., *Bruntbaler*.

Thallus less rugose, ridges on the exciple lower, more cracked, exposing the medulla.

This form seems hardly worthy of recognition. Our Tanganyika material agrees with it.

TANGANYIKA: without locality, probably East Usambara, *Braun* ex B. L. Inst. Amani 8600, in *E. African Herb.*

PARMELIA (AMPHIGYMNIA) EUNETA Stirton, *Scott. Nat.* 4:298. 1877-78.

Type: Cameroons, near Victoria, corticole, *G. Thomson*.

Thallus 5 cm. or more in diameter, lobes rounded about 10 mm. wide, margins crisped and lobulate, lobules up to 2 mm. long, mostly less than 0.5 mm. wide, some corniculate, tips truncate or retuse, margins ciliate, cilia slender, simple or sometimes forked near the tips, up to 3 mm. long; underside black, rugose, nude with occasional groups of simple rhizinae about 1 mm. long, ending in a thin disc holdfast 0.5 mm. in diameter, when in contact with the bark; upper cortex 13-15 μ thick, of fastigate pseudoparenchyma, cells somewhat irregularly arranged, highly gelified, outer half pale brown, inner half hyaline; algal layer 13 μ thick, of discrete colonies of *Trebouxia*; medulla K-, C-, KC-, 25-50 μ thick, of compactly woven, thickwalled longitudinal hyphae with occasional oblique or vertical hyphae connecting the upper and lower cortices; lower cortex 13-16 μ thick, black, pseudoparenchymatous from longitudinal hyphae, extending up the sides and over the upper surface about 50 μ to join the upper cortex.

Apothecia 10 mm. in diameter, stipe 3-4 mm. tall, margin slightly crenulate, exciple infundibuliform to deeply urceolate, deeply scrobiculate, almost pseudocyphellate along the ridges; disc very concave, liver brown to chestnut and blackening in age; amphithecial cortex 35 μ thick, of fastigate pseudoparenchyma, cells somewhat irregularly arranged; algal layer 30 μ thick, of discrete colonies, cells 5-6 μ in diameter, in places crowded, in other places widely separated; medulla loosely woven; algal layer under the parathecium 35-40 μ thick, nearly continuous; parathecium 30 μ thick, brown, of fastigate pseudoparenchyma; hypothecium 10-15 μ thick, of slender thinwalled periclinal hyphae; thecium 110-115 μ tall; paraphyses slender, dichotomous above the asci, tips slightly clavate reaching the

surface of the epithelial gel; asci ellipsoid, $50 \times 15 \mu$, thickwalled; ascospores ellipsoid, $20-23 \times 10-13 \mu$.

Our material differs from the original description in having more regularly ciliate margins and the medulla C-, KC-, instead of C faint pink and KC pink. W. A. Leighton recorded the chemical reactions of his specimen of *Gustavo Mann* as completely negative some time between 1849 and his death; my own tests confirm his statement.

GHANA (Gold Coast): Ashanti C. P. Agogo, ramulicole, T. F. Chipp 446, at Kew.

CAMEROONS: Cameroon Mt. 2255-2575 m., without collector, sent Nyl. as no. 7 but determination not recorded, det. *P. acanthifolia* Pers. by Müller Argau, herb. Hookerianum, large plants, at Kew.

FERNANDO PO: Sta. Isabel Peak, 2835 m., *Gustavo Mann*, at Kew, duplicate ex Herb. W. A. Leighton also at Kew.

PARMELIA (AMPHIGYMNIA) SCHIMPERI Müll. Arg., Hedwigia 31:276. 1892.

Type: Ethiopia, Debra, Schimper 13; Geras, Schimper 1396; Mt. Kubbi near Adoa, Schimper, none designated as type.

Thallus at least 4 cm. in diameter, deep olive buff to pale olive buff, lobes rounded, 10 mm. long, 15 mm. broad, margins sparingly short ciliate, crenate, smooth; surface smooth becoming reticulate rugose and rimulose areolate toward the center; underside black, shading to chestnut or lighter and nude at the margins, center irregularly rhizinose, rhizinae about 1 mm. long; upper cortex 15μ thick, of fastigate pseudoparenchyma, cells thinwalled, $3-4 \mu$ in diameter, the outer 10μ heavily nubilated with brownish granules; algal layer 15μ thick, nearly continuous, of single cells and small colonies of *Trebouxia*, cells $7-10 \mu$ in diameter; medulla K-, C evanescent pink next the algal layer, negative below, KC a deeper pink next the algal layer soon fading, $80-100 \mu$ thick, loosely woven throughout, slightly closer just under the algal layer and next the lower cortex, hyphae 4μ in diameter, nubilated with hyaline granules just under the algal layer; lower cortex 20μ thick, of thickwalled hyaline pseudoparenchyma, cells 6μ in diameter, only the outermost cells with thick brownish walls.

Apothecia 6-10 mm. in diameter, substipitate and urceolate at first, margins entire, inrolled, exciple white reticulate above, becoming shallowly scrobiculate below and longitudinally rugose on the very short stipe; disc remaining concave, Sanford's brown becoming auburn; amphithecial cortex 25μ thick, of fastigate thinwalled pseudoparenchyma, cells $3-4 \mu$ in diameter, the outer half heavily nubilated with red brown granules; algal layer 30μ thick, nearly continuous, of single cells and small discrete colonies, 15μ in diameter; medulla of moderately closely woven hyphae, heavily but irregularly nubilated with grayish granules; algal layer under the parathecium $15-20 \mu$ thick, nearly continuous of small colonies; parathecium 25μ thick, of fastigate thickwalled pseudoparenchyma, lumina small below, larger and deeply staining in the upper half; hypothecium 15μ thick, of very slender, moderately closely woven periclinal hyphae; thecium 115μ tall; paraphyses slender, septate, simple or once dichotomous above the asci, tips not or only very slightly enlarged, ending about 10μ below the surface of the very pale brownish epithelial gel; asci broadly clavate, $75 \times 25 \mu$, wall 3μ thick below, 15μ at the tips, protoplasts rounded, 8-spored; ascospores ellipsoid, $20-24 \times 10-13 \mu$, with a moderately thick episore.

In *Dale* L53, the apothecium sectioned is immature, the thecium about half the normal height, with a single very deeply staining young ascus.

ETHIOPIA: north side of Mt. Kubbi, truncicole in shade, *Schimper* 26 June 1837; Simien, Mindigabsa, ramulicole, *H. Scott* 323; both at Kew.

UGANDA: Bunyoro, Busingoro, 1125 m., on bark of *Jacaranda* tree, I. R. *Dale* L53; Kigezi, Naiguru ridge, 2250–2575 m., corticole, I. R. *Dale* L47 p. p. min., immature; both at Kew.

CONGO: Lugunam buga, route Kahusi, on mossy rocks, *F. L. Hendrickx* 4251, in E. African Herb.

PARMELIA (AMPHIGYMNIA) UBERRIMA Hue, Mém. Soc. Bot. France 38:9. 1916.

Type: Kenya, Blue Post on Tika River, 45 km. from Nairobi on road to Fort Hall, 1900 m., southeast of Mt. Kenya, *Poincins*.

Thallus pale glaucescent, up to $20 \times 5\text{--}6$ cm., peripheral lobes 10–20 mm. wide, rounded, smooth, somewhat scrobiculate in the center; margin centate to crenulate, ciliate, cilia 1–1.5 mm. long, slender, flexuous; underside black, paler at the margins, reticulate rugulose, center deeply rugose; upper cortex 20–60 μ thick, nubilated with dark yellow granules, fastigate, outer portion decomposed; algal layer 30–40 μ thick, continuous or partly interrupted, cells 6–10 μ in diameter; medulla K yellow, KC orange, hyphae longitudinal, densely woven, 6–10 μ in diameter with calcium oxalate crystals; lower cortex hyaline near the tips of the lobes, black toward the center, 25–60 μ thick, fastigate.

Apothecia up to 22 mm. in diameter, substipitate, margins crenulate, exciple very rugose with cilia and spermogonia; disc rufous darkening, imperforate; amphithecial cortex 60 μ thick, up to 100 μ on the ridges, fastigate; parathecium (including hypothecium) 40 μ thick; thecium 100–110 μ tall; paraphyses 4 μ in diameter, coherent, cells 8–10 μ long, lumina 1 μ in diameter, dichotomous above the asci, tips rufous; asci 70×22 μ , tips slightly thickened, base short caudate; ascospores distichous, $16\text{--}20 \times 9\text{--}11$ μ , epispore 2 μ thick.

Spermogonial wall dark about the ostiole; spermatophores 40–60 μ long, septate, branched; sperantia $8\text{--}10 \times 1$ μ , straight with truncate ends.

The above description is translated and condensed from Hue's original description, as we have no certain specimens. The Kenya specimen agrees in chemical reactions of the medulla and general habit of the thallus, but is only 80 μ thick (probably Hue prepared his sections from the thicker central part of the thallus); the upper cortex 20 μ thick, so heavily nubilated as to obscure details of structure; the algal layer is 20 μ thick, of close discrete colonies of *Trebouxia*; medulla 55 μ thick, of loosely woven longitudinal hyphae, 6–7 μ in diameter, with very few oxalate crystals; lower cortex about 15 μ thick, of dark brown, fastigate pseudoparenchyma. Our specimen is sterile and comes from a higher elevation than the type. The Uganda specimen agrees in the structure of the apothecium; parathecium 20 μ thick, pseudoparenchymatous from periclinal hyphae; hypothecium 15–20 μ thick, of slender, loosely woven periclinal hyphae; but the medulla is K–, C–, KC–.

KENYA: west slope of Mt. Kenya, along trail from West Kenya Forest Station to summit, in giant heath zone, ca. 3630 m., *Edgar A. Mearns* 1529, T. Roosevelt Smithsonian Exp., in G. K. Merrill Herb. at Farlow Herb.

UGANDA: Mt. Elgon, 1290 m., corticole, *W. Small* 217 p. p., at Kew.

PARMELIA (AMPHIGYMNIA) NEIROBIENSIS Steiner & Zahlbr., Bot Jahrb. [Engler] 60:517. 1926.

Type: Kenya, Nairobi, 1360 m., *Schroeder* 287.

Thallus 4 cm. in diameter, between buffy brown and citrine drab in the center, margins dark olive buff, lobes rounded, 10 mm. long, 13 mm. wide, margins deeply crenate, central lobes lobulate, lobules rounded, about 2 mm. long, 1.5 mm. wide with numerous spermogonia, margins smooth eciliate, neither isidiose nor sorediose, surface subcerebriform rugose in the center, smooth on marginal lobes, K yellowish, C bleached to plumbeous; underside black in the center, with close short rhizinae anchoring the thallus closely to the rough bark, marginal lobes nude, subascending, honey yellow to chamois; upper cortex 20 μ thick, surface very uneven, of fastigate pseudoparenchyma, hyphae moniliform, thinwalled, 4 μ in diameter, uppermost cell with a thicker brownish wall, all moderately nubilated with brownish granules; algal layer 25 μ thick, of close discrete colonies of *Trebouxia*, cells 5–6 μ in diameter, an occasional cell pushing up between the cortical hyphae; medulla K–, C–, KC–, 65–115 μ thick, of moderately closely woven, longitudinal hyphae, 3–4 μ in diameter, incrustated with hyaline crystals and scattered larger crystals up to 10 \times 7 μ in the air spaces; lower cortex brownish, 15 μ thick, gelified, of fastigate pseudoparenchyma, cell lumina 2 μ in diameter.

Apothecia up to 7 mm. in diameter, stipitate, stipe 1–2 mm. tall, 2–3 mm. in diameter; margin entire becoming crenulate, inrolled at first; exciple scrobiculate, ridges low and longitudinal on the stipe; disc perforate, auburn, remaining concave; amphithecial cortex 30 μ thick, of gelified, fastigate pseudoparenchyma, lumina 3 μ in diameter; algal layer of discrete colonies 30–50 μ in diameter with a few solitary cells deeper in the medulla; medulla of moderately closely woven periclinial hyphae in a layer 50 μ thick, the rest arachnoid; algal layer under the parathecium of close discrete colonies 20–50 μ in diameter; parathecium 30 μ thick, of gelified fastigate pseudoparenchyma, lumina 2 μ in diameter; hypothecium 8–9 μ thick, of slender, thinwalled, periclinial hyphae, 2 μ in diameter; moderately closely woven; thecium 80 μ tall; paraphyses slender, dichotomous above the asci, tip not thickened, ending about 6 μ below the surface of the hyaline epithelial gel; asci clavate, 65 \times 20 μ , wall 3.5 μ thick, tip not thicker, 8-spored; ascospores 12–14 \times 7–8 μ , broadly ellipsoid, with a moderately thick epispore.

Dale L51 has a somewhat smaller thallus, probably due to growing on twigs and small branches, with somewhat smaller peripheral lobes. *Eyles* 823 is smaller and sterile but agrees otherwise.

ETHIOPIA: Bagla, 1610 m., corticole, *J. M. Hildebrandt*, July 1872, sub *P. abessinica* ex herb. Sbarbaro at Farlow Herb.

KENYA: Northern Frontier Province, Dandu, 3° 26' N., 39° 54' E., 1127 m., on trees, *J. B. Gillett* 12691, at Kew; northeast slope of Mt. Elgon, 2575 m., *A. Burnet* L30a; North Kajiado, *A. Burnet* L33, both in Makerere College Herb.

UGANDA: Bunyoro, Busingoro, 1130 m., on *Poinsettia* bark, *I. R. Dale* L51, on *Jacaranda* bark, *I. R. Dale* L60 p. p. min.; Kigezi, Naiguru Ridge, 2250–2575 m., corticole, *I. R. Dale* L47; Mafuga, 2415 m., corticole, *I. R. Dale* L50 p. p. min., all at Kew; north-west Longido, *A. Burnet* L46, Makerere College Herb.

TANGANYIKA: Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna* sp., *A. A. Bullock* 1871 p. p. min., International Red Locust Control Service, at Kew.

SOUTHERN RHODESIA: Makoni District, 1550 m., *Frederick Eyles* 823, at Kew.

ANGOLA: nordeste da Lunda, Dundo near Rio Luachima, 750 m., on small branches of tall trees of gallery wood, *J. Gossweiler* 13928 p. p. min., Explorações da Companhia de Diamantes, at Kew.

PARMELIA (AMPHIGYMNIA) *Thomasii* Dodge, sp. nov.

Type: Uganda, Mt. Otse, West Nile, 1610 m., on tree branches at rocky summit, *A. S. Thomas* 1962, at Kew.

Thallus ad 7 cm. diametro, obscure griseo-olivaceus vel pallidior, laevis, reticulatim rimulosus, lobis rotundatis, marginibus crispatis, eciliatis, partim sparse lobulatis, lobulis 1 mm. longitudine latitudineque, apicibus plus minusve truncatis; infra niger, marginibus late cinnamomeo-alutaceis, reticulatim rugosus, sine rhizinis typicis, hapteris 1 mm. diametro, ramosis, in centro thalli; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5 μ diametro, granulis griseis nubilatis; stratum algarum 25 μ crassitudine, coloniis discretis *Trebouxiae*, cellulis 10 μ diametro; medulla K-, C-, KC-, 30–100 μ crassitudine, hyphis longitudinalibus 5 μ diametro, dense intertextis; cortex inferior 20 μ crassitudine, niger, pseudoparenchymaticus ex hyphis longitudinalibus, cellulis 5 μ diametro.

Apothecia ad 20 mm. diametro, stipite 2 mm. altitudine atque latitudine, sulcato, margine laevis, primo inflexo dein in lobis 4 mm. longitudine, latitudine variabili; excipulo reticulatim rugosus, disco concavo dein plano, perforato, castaneo-brunneo; cortex amphithecialis 25 μ crassitudine, fastigiatus, dimidia parte externa brunea, gelifacta; stratum algarum coloniis discretis ad 50 μ diametro; stratum algarum sub parathecio coloniis discretis sed compactioribus, 30 μ diametro; parathecium 25 μ crassitudine, pseudoparenchymaticum ex hyphis pachydermeis, periclinialibus conglutinatis; hypothecium 10–15 μ crassitudine, hyphis leptodermeis periclinialibus laxae intertextis; thecium 80 μ altitudine; paraphyses tenues, septatae, bis terve dichotomae super ascos; ramis submoniliformibus, cellula ultima subclava; asci ellipsoidei, ca. 65 \times 25 μ , pachydermei, apicibus incrassatis; ascosporae octonae (frequenter 4 ascosporis abortis), episporio crasso, 14–16 \times 10 μ .

Thallus up to 7 cm. in diameter, deep grayish olive to light grayish olive, surface smooth, reticulate rimulose, deeply rimose in older portions where it may be slightly rugose, lobes rounded, margins crisped, eciliate, some entire, others sparsely lobulate, lobules about 1 mm. long, less than 1 mm. wide, tips truncate; underside with cinnamon buff margins, deeply reticulate rugose, typical rhizinae absent, holdfast about 1 mm. in diameter, formed of branched fibers resembling small haptera in the Umbilicariaceae, scattered over the central portion of the thallus; upper cortex 20 μ thick, of fastigiate pseudoparenchyma, cells 5 μ in diameter, very heavily nubilated with grayish granules; algal layer 25 μ thick, of discrete colonies of *Trebouxia*, from close to scattered, cells up to 10 μ in diameter; medulla K-, C-, KC-, 30–100 μ thick, of closely woven, longitudinal hyphae 4–6 μ in diameter with small air spaces under the ridges of the lower cortex; lower cortex 20 μ thick, black, pseudoparenchymatous from longitudinal hyphae, cells 6 μ in diameter.

Apothecia up to 20 mm. in diameter, stipe 2 mm. tall, 2 mm. in diameter, margin entire, inrolled at first, splitting into lobes 4 mm. long, of variable widths;

exciple very deeply and minutely reticulate rugose, cortex not cracking along the ridges; disc very concave becoming plane and perforate, chestnut brown; amphithelial cortex $25\ \mu$ thick, fastigiate, the outer half deep brown, gelified; algal layer of discrete colonies $50\ \mu$ in diameter; algal layer under the parathecium of close discrete colonies $30\ \mu$ in diameter; parathecium $25\ \mu$ thick, pseudoparenchymatous from conglutinate, moderately thickwalled, periclinal hyphae; hypothecium $10\text{--}15\ \mu$ thick, of loosely woven periclinal hyphae; thecium $80\ \mu$ tall; paraphyses slender, septate, twice or thrice dichotomous above the asci, branches somewhat moniliform, terminal cell slightly clavate ending in the brownish epithecial gel; asci ellipsoid, $65 \times 25\ \mu$, 8-spored at first but often about 4 spores abort, very thickwalled with a thicker tip; ascospores ellipsoid, $14\text{--}16 \times 10\ \mu$, with a moderately thick episporium.

At first sight this species looks like a very large *Leptogium*.

UGANDA: Mt. Otse, West Nile, 1610 m., on tree branches at the rocky summit, A. S. Thomas 1962, type; Kigezi, Naiguru ridge, 2415 m., corticole, I. R. Dale L49; Mafuga, 2415 m., I. R. Dale L50, all in Kew.

PARMELIA (AMPHIGYMNIA) *litoralis* Dodge, sp. nov.

Type: Kenya, Kilifi, on coastal rocks, Matt Cass, com. P. R. O. Bally, Scott Agr. Lab., at Kew, duplicate in E. African Herb.

Thallus 4 cm. diametro, dilute olivaceo-alutaceus, lobis rotundatis, 10 mm. longitudine latitudineque, marginibus dentatis lobulatisve, lobulis 1 mm. longitudine latitudineque, apicibus truncatis rotundatisve, eciliatis, tenuiter nigromarginatis; inferne niger, minute reticulatim rugulosus, rhizinis brevibus; cortex superior $15\ \mu$ crassitudine, fastigiatus, hyphis $4\ \mu$ diametro, granulis brunneis nubilatis; depressionibus strato amorpho $15\ \mu$ crassitudine tectis; stratum algarum $15\ \mu$ crassitudine, coloniis parvis cellulisque sparsis *Trebouxiae*, $4\text{--}6\ \mu$ diametro; medulla K-, C-, KC-, $110\text{--}115\ \mu$ crassitudine hyphis longitudinalibus $4\text{--}5\ \mu$ diametro intertextis, paucis cum hyphis verticalibus, granulis brunneis nubilatis; infra hyphis laxius intertextis; cortex inferior niger, $20\text{--}30\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis $7\text{--}8\ \mu$ diametro.

Apothecia $4\text{--}5\ \mu$ diametro, marginibus inflexis crenulatisque, excipulo laevi, disco concavo, subaurantiaco; cortex amphithecialis $55\ \mu$ crassitudine, fastigiatus, gelifactus, hyphis $8\text{--}9\ \mu$ diametro, granulis brunneis nubilatis; stratum algarum coloniis discretis, $15\ \mu$ diametro; medulla arachnoidea; stratum algarum sub parathecio $25\text{--}30\ \mu$ crassitudine, coloniis discretis; parathecium $30\ \mu$ crassitudine, pseudoparenchymatice fastigiatum, cellulis $3\text{--}4\ \mu$ diametro; hypothecium $8\ \mu$ crassitudine, gelifactum, hyphis periclinalibus; thecium $80\ \mu$ altitudine; paraphyses tenues, sparsim septatae, cellula ultima subclavata; asci clavati, $60 \times 22\text{--}23\ \mu$, membrana $3\ \mu$ crassitudine, apice $6\ \mu$; ascosporae octonae (frequenter 4 ascosporis abortis) ellipsoideae, $16 \times 10\ \mu$ (in ascis 4-sporis $18\text{--}20 \times 10\text{--}12\ \mu$), episporio $2.5\ \mu$ crassitudine.

Thallus fragment 4 cm. in diameter, probably larger, pale olive buff, lobes rounded, 10 mm. wide and long, margin dentate to lobulate, lobules about 1 mm. long and wide, tips rounded or truncate, eciliate, narrowly black margined; underside black to the margins, minutely reticulate rugulose; rhizinae mostly torn away in removing from the rock, very short, stout, ending in a disciform holdfast up to

1 mm. in diameter; upper cortex 15 μ thick, fastigate, hyphae 4 μ in diameter, heavily nubilated with brownish granules, in the depressions covered by an amorphous layer up to 15 μ thick; algal layer 15 μ thick, of solitary cells and small colonies of *Trebouxia*, cells 4–6 μ in diameter; medulla K–, C– or very faint yellow, KC–, 110–115 μ thick, of moderately closely woven longitudinal hyphae, 4–5 μ in diameter, with some vertical hyphae, heavily nubilated with brownish granules except in the lower 15–30 μ where it is loosely woven with air spaces; lower cortex 20–30 μ thick, black, of fastigate pseudoparenchyma, cells 7–8 μ in diameter.

Apothecia 4–5 mm. in diameter, remaining urceolate with inrolled crenulate margins, exciple smooth, disc concave between Mars orange and burnt sienna; amphithecial cortex 55 μ thick, gelified, fastigate, hyphae 8–9 μ in diameter, nubilated with brownish granules in the outer 15 μ ; algal layer 15 μ thick, of discrete colonies, heavily nubilated with brownish granules; medulla arachnoid, with air spaces 100 μ in diameter below, moderately closely woven above; algal layer under the parathecium 25–30 μ thick, of discrete widely spaced colonies, dying out in places; parathecium 30 μ thick, of fastigate pseudoparenchyma, cells 3–4 μ in diameter, lumina 1 μ below, 2–3 μ in diameter in the upper 10–12 μ and the surrounding gel staining with phloxine; hypothecium 8 μ thick, gelified, of slender periclinal hyphae, close above, less so below; thecium 80 μ tall; paraphyses slender, sparsely septate, simple or once dichotomous near the tips, terminal cell slightly clavate, ending 4–6 μ below the surface of the brownish epithelial gel; asci clavate, 60 \times 22–23 μ , wall 3 μ thick, tips 6 μ , 8-spored at first but often only 4 spores mature; ascospores 16 \times 10 μ in 8-spored asci, 18–20 \times 10–12 μ in 4-spored asci, ellipsoidal, epispore 2.5 μ thick.

KENYA: Kilifi, on coastal rocks, *Matt Cass*, com. P. R. O. Bally, Scott. Agr. Lab., type, at Kew and duplicate in E. African Herb.

PARMELIA (AMPHIGYMNIA) APPENDICULATA Fée, Suppl. Essai Crypt. Ecorces Officin. 118. 1837; Nyl., Syn. Meth. Lich. 1:381. 1860.

Type: Réunion, ramicole.

Thallus up to 12 cm. in diameter, olive buff, lobes irregular dichotomous with rounded sinuses, peripheral lobes rounded up to 10 mm. long and wide, margins crenate with either acute or rounded sinuses, cilia rather close, 2–3 mm. long; central lobes variously lobulate, the longer 4–5 mm. long, 0.4–0.5 mm. wide, once or twice dichotomous, convex, the shorter simple with revolute margins, corniculate, tips rounded; underside black, shining, margins nude, Brussels brown, lobules light ochraceous buff at the tips; rhizinae stout, short, dense in groups 3 mm. in diameter; upper cortex 25 μ thick, of fastigate pseudoparenchyma, hyphae 6–7 μ in diameter, heavily nubilated with greenish brown granules; algal layer up to 15 μ thick, of discrete small colonies of *Trebouxia* and single cells 5–6 μ in diameter, somewhat nubilated; medulla K–, C–, KC–, 35–50 μ thick, of loosely woven hyphae 3 μ in diameter, slightly nubilated, with about as many vertical as longitudinal hyphae; lower cortex 20 μ thick, of fastigate pseudoparenchyma.

Apothecia 8–12 mm. in diameter, pedicellate, margins lobulate-fimbriate, exciple scrobiculate, rufescent, disc dark rufous fuscous; ascospores 27–31 \times 11–18 μ .

As our specimen is sterile, the description of apothecia is translated from Nylander, *l.c.*

MAURITIUS: without locality or collector, com. C. H. Peck 4 to Tuckerman in 1869, now in Tuckerman Herb. sub *P. perlata* v. *ciliata*, f. *dissecta*, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) NITENS Müll. Arg., Bot. Jahrb. [Engler] 20:255. 1894.

Type: Tanganyika, Usambara, Bukoba District, lake region, *Stuhlmann 4*.

Thallus up to 14 cm. in diameter, mostly deep olive buff, some peripheral lobes bleached to pinkish buff, others not; peripheral lobes up to 2 mm. long, 10 mm. wide below, expanding to 20 mm. wide above, deeply crenate into 3 rounded lobes, somewhat crisped, central lobes smaller, deeply crenate, forming lobules 1–2 mm. wide and long, margins revolute, tips rounded, with microphylline lobules regenerating from injury; surface smooth, subnitid on peripheral lobes, shallowly reticulate rugose and somewhat rimulose areolate in the central portion; underside black, minutely reticulate rugulose, margins variously snuff brown, bister and sayal brown, central rhizinae short, stout, black, several uniting in a common holdfast 1–2 mm. in diameter, groups in center of paler peripheral lobes short pale, subpellucid where not making contact with the substrate; upper cortex 10 μ thick, of fastigate pseudoparenchyma, cells 3 μ in diameter, heavily nubilated with brownish granules; algal layers of discrete colonies of *Trebouxia*, 20–25 μ in diameter, cells 7–10 μ in diameter, heavily nubilated with brownish granules; medulla K–, C pink, KC–, 65–70 μ thick, of closely woven, longitudinal hyphae 2–3 μ in diameter, with some small air spaces, irregularly nubilated with grayish brown granules; lower cortex 10 μ thick, of fastigate pseudoparenchyma, cells 3 μ in diameter, lumina 1 μ , outermost cells with very dark walls and nubilated, inner cells with paler walls without granules.

Apothecia 10 (–15) mm. in diameter, urceolate with entire inrolled margins, finally flattened by splitting into segments; exciple smooth finally shallowly reticulate rugulose with predominantly radial ridges, disc imperforate, auburn, smooth becoming bullate and subrugose in old flattened apothecia; amphithecial cortex 20–25 μ thick, of fastigate pseudoparenchyma, cells 3 μ in diameter, outer half heavily nubilated with brownish granules, inner half hyaline; algal layer 30 μ thick, nearly continuous, cells 6–7 μ in diameter; medulla moderately closely woven; algal layer under the parathecium 15 μ thick, continuous; parathecium 25 μ thick, of gelified pseudoparenchyma from periclinal hyphae, protoplasts about 3 μ in diameter; hypothecium 15 μ thick, of slender, branched periclinal hyphae, rather loosely woven; thecium 65–70 μ tall; paraphyses slender, septate, dichotomous above the asci, branches moniliform, tips not enlarged, ending about 10 μ below the surface of the brownish epithelial gel; asci clavate, 52 \times 23 μ , wall 3 μ thick, tips 4–5 μ , 8-spored; ascospores short ellipsoid, 10–12 \times 8–9 μ , epispore 1.5–2 μ thick.

Dale L54 was badly eaten by insects, losing most of the upper cortex and some of the lower cortex.

UGANDA: Bunyoro, Busingoro, 1130 m., on bark of old *Jacaranda* tree, *I. R. Dale L54*,

L68a; Toro District, Fort Portal, 1775 m., on *Eucalyptus tereticornis*, I. R. Dale L38 p. p.; same locality and substrate but 1625 m., I. R. Dale L44; all at Kew.

NYASALAND: without locality, a fragment, L. J. Brass 2, Vernay Nyasaland Exp., in Dodge Herb.

PARMELIA (AMPHIGYMNIA) ramulicola Dodge, sp. nov.

Type: Madagascar, on decorticate twigs, J. M. Hildebrandt, sub *P. acanthifolia*, ex herb. Sbarbaro, at Farlow Herb.

Thallus ramulicola, 5×2.6 cm., dilute ochraceo-alutaceus, monophyllus, marginibus eciliatis, alte crenatis, lobulis 2 mm. longitudine, 1–4 mm. latitudine; infra sepiaceus, marginibus ochraceo-alutaceis, rhizinae 0.3 mm. longitudine; cortex superior 30μ crassitudine, fastigiatus, hyphis $3\text{--}4 \mu$ diametro, cellulis superiores 5μ diametro, $5\text{--}10 \mu$ longitudine; stratum algarum 15μ crassitudine, continuum, cellulis $6\text{--}7 \mu$ diametro, nubilatis; medulla K–, C–, KC–, 80μ crassitudine, sub strato algarum subarachnoidea, infra hyphis longitudinalibus, 3μ diametro, granulis griseis nubilatis; cortex inferior 7μ crassitudine, cellulis pachydermeis, 7μ diametro.

Apothecia ad 6 mm. diametro, sessilia, marginibus integris subcrenatisve, excipulo laevi, disco brunneo imperforato; cortex amphithecialis 50μ crassitudine, pseudoparenchymatice fastigiatus; stratum algarum 20μ crassitudine, continuum, cellulis 7μ diametro; medulla laxa contexta; stratum algarum sub parathecio 50μ crassitudine; parathecium 30μ crassitudine, fastigiatum, hyphis 7μ diametro; hypothecium 35μ crassitudine, hyphis pachydermeis, gelifactis, 3μ diametro, luminibus 1μ ; thecium 65μ altitudine; paraphyses tenues, dichotomae super ascos, ramis submoniliformibus, apicibus clavatis, 6μ diametro; asci clavati, $40 \times 12\text{--}13 \mu$, pachydermeis; ascosporae octonae, ellopsoideae, $9\text{--}10 \times 4\text{--}5 \mu$, episporio crasso.

Thallus monophyllous, completely investing decorticate twigs, margins slightly overlapping, very closely appressed throughout, 5 cm. long, 26 mm. wide, pale ochraceous buff, margins eciliate, entire in places or very deeply crenate, cutting the margin into lobules 1–4 mm. wide, about 2 mm. long, surface rugose in the center, K yellow, mouths of spermogonia scarlet, margins smooth; underside sepia in the center, abruptly pale ochraceous buff toward the margins, dark portion verrucose, pale portion smooth, opaque; rhizinae close in small groups, 0.3 mm. long, forming holdfasts at their tips; upper cortex 30μ thick, the upper 10μ a palisade of brownish cells $10 \times 5 \mu$, or two cells 5μ in diameter, nubilated with brownish granules, the rest of dichotomous vertical hyphae $3\text{--}4 \mu$ in diameter, with scattered algal cells pushing up between the hyphae; algal layer continuous, 15μ thick, of moderately closely packed cells $6\text{--}7 \mu$ in diameter, very heavily nubilated; medulla K–, C–, KC–, 80μ thick, almost arachnoid with large air spaces under the algal layer, more closely woven below, of longitudinal hyphae 3μ in diameter, heavily but very irregularly nubilated with grayish granules except in the lower 15μ ; lower cortex 7μ thick, a single layer of cells with thick, very pale brown walls.

Apothecia up to 6 mm. in diameter, sessile, urceolate at first, flattened in the middle but margins erect, entire to subcrenate, exciple smooth, radially rugose

below; disc imperforate, auburn or darker; amphithecium cortex $50\ \mu$ thick, fastigiate, the outer half of hyphae $7\ \mu$ in diameter, protoplasts ellipsoidal $7 \times 3\ \mu$, the inner half of vertical, septate hyphae, protoplasts $2\ \mu$ in diameter; algal layer $20\ \mu$ thick, continuous, cells $7\ \mu$ in diameter, not closely packed; medulla loosely woven with large air spaces; algal layer under the parathecium $202\ \mu$ thick, parathecium $30\ \mu$ thick, fastigiate, hyphae $7\ \mu$ in diameter, lumina $1\ \mu$; hypothecium $35\ \mu$ thick, gelified, of periclinal hyphae $3\ \mu$ in diameter, lumina $1\ \mu$; thecium $65\ \mu$ tall; paraphyses slender, dichotomous above the asci, branches submoniliform, terminal cells clavate, $6\ \mu$ in diameter, reaching the surface of the brownish epithelial gel; asci clavate, $40 \times 12\text{--}13\ \mu$, wall $3\ \mu$ thick, tip $4\ \mu$, protoplast mamillate when young, 8-spored; ascospores ellipsoidal, $9\text{--}10 \times 4\text{--}5\ \mu$, with a thick episore.

MADAGASCAR: on decorticate twigs, J. M. Hildebrandt, sub *P. acanthifolia*, ex herb. Sbarbaro, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) SOYAUXX Müll. Arg., Linnaea 63:32. 1880.

Type: Angola, Pungo Andongo, saxicole, *Soyaux*.

Thallus more than 11 cm. in diameter, $130\text{--}150\ \mu$ thick, pale olive buff, K yellow, lobes up to 20 mm. wide, suberect, crisped, margins crenate, smooth, rimulose in the older portions, white reticulate; underside black, minutely rugulose; rhizinae few, simple or branched at the tips forming the holdfasts; upper cortex $15\ \mu$ thick, of thinwalled pseudoparenchyma, about 2 cells thick, heavily incrustated with yellowish granules; algal layer $30\ \mu$ thick, continuous, cells of *Trebouxia* $5\text{--}6\ \mu$ in diameter; medulla K-, C red, KC-, $80\ \mu$ thick, of loosely woven longitudinal hyphae, $3\ \mu$ in diameter, more closely woven next the lower cortex; lower cortex $12\text{--}15\ \mu$ thick, of septate brown conglutinate hyphae, sometimes cracking away and leaving the lower portion of the medulla to form a pale buff pseudocortex.

Apothecia, up to 35 mm. in diameter, stipe 10 mm. tall, 4 mm. in diameter, margin inrolled, crenate, exciple smooth to very slightly rugulose, disc auburn, deeply concave at first becoming nearly plane, perforate in old apothecia; amphithecium extending about 0.5 mm. beyond the thecium; amphithecium cortex $25\ \mu$ thick, fastigiate, of relatively thinwalled pseudoparenchyma; algal layer $15\ \mu$ thick, continuous; medulla closely woven, heavily nubilated with hyaline granules in a layer $15\ \mu$ thick below the algal layer; algal layer under the parathecium $15\text{--}20\ \mu$ thick, continuous; parathecium gelified, $20\ \mu$ thick, of periclinal hyphae; hypothecium $10\text{--}12\ \mu$ thick, of slender periclinal hyphae; thecium $55\text{--}60\ \mu$ tall; paraphyses slender, septate, tips slightly clavate reaching the surface of the brownish epithelial gel; asci clavate, $40 \times 20\ \mu$, wall about $2\ \mu$ thick, tips thicker, 8-spored; ascospores ellipsoidal, $12\text{--}16 \times 7\text{--}8\ \mu$, with a thick episore.

Spermatogonia oblate spheroidal, $105\ \mu$ tall, $130\ \mu$ in diameter, immersed in the medulla, neck about $15\ \mu$ long, $25\ \mu$ in diameter, wall wholly carbonaceous at maturity, pseudoparenchymatous; spermatophores simple or dichotomous near the base, $20 \times 1\ \mu$; spermatia cylindric, straight, $16\text{--}18 \times 1\ \mu$.

When the thecium is eaten away by insects, the parathecium functions as a cortex, concolorous with the thallus. In *Tindall M5976* the thallus is somewhat distorted from being completely wrapped around the crotch of a branch about

1 cm. in diameter. The Gossweiler fragments are old, the thecia eaten away from most of the large apothecia, and the medulla is KC red.

SIERRA LEONE: Sugar Loaf Mt., on dead tree, *H. D. Tindall* com. *F. C. Deighton* M5976; Picket Hill, 740 m., *T. S. Jones* com. *F. C. Deighton* M4592; both at Kew.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, sur de Boka de Titiekro, corticole, *Guy Roberty* 12673 p. p. min. in Conservatoire Bot. Genève.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, *J. Gossweiler*, fragments, at Kew.

UGANDA: Sese, Towa forest, 1225 m., on rocks in grassland, *A. S. Thomas* 3028; E. Tropical Africa between 2° and 7° S., without more definite locality, *James Hannington*; both at Kew.

PARMELIA (AMPHIGYMNIA) Robertyi Dodge, sp. nov.

Type: Côte d'Ivoire, Moyenne, triangle aride de Toumodi, Bouallé, Boka de Titiekro, *Guy Roberty* 13041, in Conservatoire Bot. Genève.

Thallus 9 cm. diametro, inter obscure olivaceo-alutaceus et fumosus, lobis periphericis 20 mm. diametro, rotundatis, marginibus subcrispatis; lobis centralibus subdentatis, lobulatis, eciliatis, sine isidiis sorediisque; infra niger, minute reticulatim rugulosus, marginibus fulvo-olivaceis, laevibus, nitidis, rhizinis brevibus, densis in areolis sparsis, apicibus ramosis; cortex superior 20 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro, granulis brunneis nubilatis; stratum algarum 30 μ crassitudine, subcontinuum, coloniis *Trebouxiae*, cellulis 5–6 μ diametro; medulla K flava dein aurantiaca, C–, KC–, 80 μ crassitudine, hyphis longitudinalibus laxe intertextis; cortex inferior 30 μ crassitudine, fastigiatus, gelifactus.

Apothecia submarginalia in lobis centralibus, 20 mm. diametro, stipite 3–4 mm. altitudine, 4 mm. diametro, longitudinaliter subrugoso; margine integro, excipulo subimpresso, minute albo-reticulato; disco perforato, brunneo; cortex amphithecialis 25 μ crassitudine, fastigiatus, gelifactus; stratum algarum 25 μ crassitudine, coloniis discretis cellulisque sparsis; medulla arachnoidea; stratum algarum subparathecio 30 μ crassitudine, continuum; parathecium 40 μ crassitudine, pseudoparenchymaticum ex hyphis periclinalibus; hypothecium vix evolutum; thecium 95 μ altitudine; paraphyses tenues, septatae, semel bisve dichotomae super ascos, ramis submoniliformibus, apicibus anguste clavatis; asci late clavati subcylindrici 40 \times 13 μ ; ascosporae octonae, distichae, late ellipsoideae, 13–14 \times 7–8 μ .

Thallus 9 cm. in diameter, probably larger, between deep olive buff and smoke gray, peripheral lobes 20 mm. in diameter, rounded, margins entire, somewhat crisped, central lobes somewhat dentate to lobulate, without cilia, isidia or soredia, surface smooth not rimulose, or finally slightly so in the central portion; underside black, reticulate rugulose, margins tawny olive or somewhat lighter, nearly smooth and shining; rhizinae central, short dense in scattered groups, tips closely branched to form holdfasts in contact with the bark; upper cortex 20 μ thick, of fastigate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granules; algal layer 30 μ thick, subcontinuous from colonies of *Trebouxia*, cells 5–6 μ in diameter, less densely packed than in most species; medulla K yellow then orange, fading slowly, C–, KC–, 80 μ thick, of predominantly longitudinal hyphae, rather

loosely woven; lower cortex $30\ \mu$ thick, highly gelified but apparently fastigiate with a few included granules, only slightly brownish in section.

Apothecia submarginal on the central lobes, 20 mm. in diameter, stipe 3–4 mm. tall, 4 mm. in diameter, shallowly longitudinally rugose; margin entire, exciple somewhat impressed, minutely white reticulate, disc perforate, Dresden brown; amphithecial cortex $25\ \mu$ thick, gelified, fastigiate; algal layer $25\ \mu$ thick, of discrete small colonies and single cells; medulla very loosely woven and tearing on sectioning; algal layer under the parathecium $30\ \mu$ thick, continuous, with scattered cells deeper in the medulla; parathecium $40\ \mu$ thick, pseudoparenchymatous from moderately thickwalled periclinal hyphae; hypothecium scarcely differentiated, but the upper $6\text{--}8\ \mu$ of the parathecium less gelified with thinner walls; thecium $95\ \mu$ tall; paraphyses slender, septate, once or twice dichotomous above the asci, branches submoniliform, tips narrowly clavate, ending in the brownish epithecial gel; asci subcylindric to broadly clavate, $40 \times 13\ \mu$, wall and tip thickened when young, becoming thinwalled, at maturity, 8-spored; ascospores distichous, ellipsoidal, $13\text{--}14 \times 7\text{--}8\ \mu$, with a rather thin episore.

This species belongs to the group of *P. Soyauxii*, but with a taller thecium, almost no hypothecium, a thicker parathecium and thinner walled asci and ascospores. It also differs in chemical reactions of the medulla.

SIERRA LEONE: without locality, *Charles Barter*; Ksballa 385 m., *N. W. Thomas 2192*; Falaba, on *Nispera* sp., *D. Small 450*; all at Kew.

CÔTE D'IVOIRE: Moyenne, triangle aride de Toumodi, Bouallé, Boka de Titiékro, *Guy Roberty 13941*, in Conservatoire Bot. Genève.

PARMELIA (AMPHIGYMNA) ZAMBESICA Müll. Arg., Verhandl. Zool. Bot. Ges. Wien 43:296. 1893.

Parmelia africana v. *zambesica* Steiner & Zahlbr., Bot. Jahrb. [Engler] 60:535. 1926.

Type: Northern Rhodesia, near Boroma, *Menyhart 268, 269, 475*.

Thallus at least 9 cm. in diameter, between chamois and cream buff, peripheral lobes up to 25 mm. long, 15 mm. wide, irregularly dichotomous with rounded sinuses, ultimate lobules rounded about 4 mm. in diameter, margins subascending, crisped, sinuate, smooth, eciliate; surface smooth, opaque, slightly rugulose toward the center; underside black, shading to between Sanford's brown and auburn, very minutely rugulose; rhizinae in small dense groups, up to 1 mm. long when not making contact with the substrate, stouter and shorter forming small disc holdfasts when in contact; upper cortex $25\ \mu$ thick, fastigiate, terminal cells $12 \times 6\ \mu$, heavily nubilated with brownish granules, dichotomous below, hyaline; algal layer $15\ \mu$ thick, of discrete colonies of *Trebouxia* in a nearly continuous layer, cells $4\text{--}5\ \mu$ in diameter, heavily nubilated with brownish granules; medulla K– or very faintly yellowish, C–, KC– or very faintly yellowish, $100\ \mu$ thick, of closely woven longitudinal hyphae, $4\text{--}5\ \mu$ in diameter, very heavily nubilated with brownish granules; lower cortex black, $20\ \mu$ thick, of fastigiate pseudoparenchyma, cells $3\ \mu$ in diameter with very dark brown, moderately thick walls.

Apothecia up to 14 mm. in diameter, urceolate then expanded but remaining cupulate, margin entire or minutely crenulate, exciple smooth, then slightly and minutely impressed and shallowly reticulate rugulose, disc auburn; amphithecial

cortex 115 μ thick, of gelified fastigate pseudoparenchyma, cells 10 μ in diameter, the outer half somewhat nubilated with brownish granules; algal layer 40–50 μ thick, continuous, very heavily nubilated with brownish granules, cells 6–7 μ in diameter; medulla closely woven, very heavily nubilated with brownish granules; algal layer under the parathecium 30 μ thick, continuous, heavily nubilated with brownish granules; parathecium 40 μ thick, of fastigate pseudoparenchyma, protoplasts about 3 μ in diameter, somewhat irregularly arranged, gel deeply staining with phloxine, some algal cells pushing up between the hyphae in the lower 15 μ ; hypothecium 55 μ thick, of periclinal gelified hyphae in the lower half, lumina about 2 μ in diameter, bending upward to the thecium in the upper half; thecium 100 μ tall; paraphyses slender, sparsely septate, dichotomous above the asci, branches slightly moniliform, terminal cells not enlarged, ending 10–12 μ below the surface of the epithelial gel; asci clavate, 65 \times 20 μ , wall 2 μ thick, tips 3–4 μ , 8-spored; ascospores ellipsoidal, 16 \times 8 μ , with a very thin episore.

TANGANYIKA: Mulinda forest, southeast of Tukuyu (New Langenberg), 900 m., growing over roots of *Rangaenia muscicola* (orchid) on bark, A. Stolz 2577A, at Kew.

PARMELIA (AMPHIGYMNIA) HYPORYSALEA Vainio, Bot. Mag. Tokyo 35:47. 1921.

Parmelia olivetorum v. *hyposysalea* Vainio, Cat. Welwitsch African Pl. 2:399. 1901.

Type: Angola, Huila, Morro de Lopolo, 1225–1775 m., *Welwitsch* 6, 27; Lake of Great Hippopotamus or Ivantala, *Welwitsch* 26; Serra da Chela, *Welwitsch* 28; none designated as type.

Thallus 10 cm. in diameter, deep olive to dark olive buff, lobes 10 mm. long, 5 mm. wide at the base, expanding to 20 mm. wide above, rounded, crisped, surface smooth to minutely rugulose in the center, margins microphylline, lobules about 1 mm. wide and long; underside black with cinnamon brown margins; rhizinae rare, coarse, 1 mm. long; upper cortex 15 μ thick, of fastigate pseudoparenchyma, very heavily nubilated with grayish granules in a brownish gel; algal layer 15–20 μ thick, of discrete colonies of *Trebouxia*, sometimes close, sometimes widely spaced, cells 6–7 μ in diameter, with an occasional cell deeper in the medulla; medulla K–, C red, KC red, 100 μ thick, of loosely woven, moderately thickwalled hyphae, 3–4 μ in diameter, closer and more longitudinal next the lower cortex; lower cortex 15 μ thick, of deep brown, conglutinate, thickwalled hyphae.

Apothecia submarginal, up to 30 mm. in diameter, stipe 5–7 mm. tall, about 5 mm. in diameter when mature, deeply scrobiculate with predominantly longitudinal ridges; margins entire becoming crenulate and finally microphylline in very old apothecia; exciple deeply reticulate rugose below, smooth above, disc mummy brown, urceolate at first, becoming nearly plane at maturity; amphithecial cortex 80 μ thick, fastigate, of very thickwalled, conglutinate hyphae, deep brown in the outer 25 μ , hyaline within; algal layer 25–30 μ thick, of discrete colonies, mostly close; algal layer under the parathecium 30–35 μ thick, with an occasional cell deeper in the medulla, subcontinuous; parathecium 30–35 μ thick, of fastigate thickwalled pseudoparenchyma, lumina somewhat larger and more deeply staining in the upper half; hypothecium 15 μ thick, of thinwalled periclinal hyphae, closely interwoven; thecium 60 μ tall; paraphyses slender, septate, more closely so

above, terminal cells clavate, heavily nubilated with grayish granules in the deep brown epithelial gel; asci broadly clavate, becoming ellipsoid, $42 \times 14 \mu$, thick-walled, 8-spored but sometimes less than 8 mature; ascospores $13-16 \times 6-7 \mu$ ($15-18 \times 8-10 \mu$, fide Vainio).

Gossweiler 1725 agrees with Vainio's brief description except in medullar reaction C red in the original description, practically negative in ours with just a trace of red under the algal layer, and slightly larger spores; perhaps Vainio's measurements were taken of spores from asci with fewer than 8 spores. The medulla of Bullock 2103 gives a clear C red reaction next the algal layer, but is practically negative next the lower cortex; Bullock 1871 gives C red, KC red throughout but the color slowly fades.

ANGOLA: Benguela, country of the Ganguelas and Ambuelas, J. Gossweiler 1725, at Kew.

TANGANYIKA: Ufipa, Malonje, 2575 m., on roots of *Aerangis* sp. on *Ochna* sp., A. A. Bullock 1871 p. p. min., International Red Locust Control Service, at Kew.

NORTHERN RHODESIA: Abercorn, on roots of *Tridactyle* sp. on *Brachystegia taxifolia*, in dense shade of crown, A. A. Bullock 1108, 2103 pars, International Red Locust Control Service, at Kew.

PARMELIA (AMPHIGYMNIA) AFRICANA Müll. Arg., Flora 63:265. 1880.

Parmelia abessinica v. *nuda* Müll. Arg., Flora 62:289. 1879.

Type: Southwest Sudan, Djur, Dem Sekir and Scriba Ghattas, lignicole, *Schweinfurth*. The description below based on portion of the latter collection, at Farlow Herb.

Thallus at least 10 cm. in diameter, probably larger, between citrine drab and dark olive buff, lobes imbricate, about 10 mm. wide, 20 mm. long, rounded, somewhat crisped, sinuses somewhat excised, surface smooth, margin entire narrowly black margined; central portion deeply rugose; underside black in the center, shading to russet margins, rugose with very few coarse rhizinae; upper cortex 20μ thick, fastigate in the upper 13μ , heavily nubilated with brown granules, less regular and hyaline below; algal layer of discrete colonies of *Trebouxia*, 15μ in diameter, rather scattered in the lobes sectioned, cells 5μ in diameter; medulla K-, C deep pink, KC deep pink, soon fading, 80μ thick, of moderately close woven mostly longitudinal hyphae $5-6 \mu$ in diameter, lumina about 1μ ; lower cortex 15μ thick, fastigate, of a single layer of conglutinate, thickwalled cells $15 \times 7 \mu$.

Apothecia pedicellate when young, 7-10 mm. in diameter, margin entire to slightly crenate, exciple smooth to slightly impressed, disc auburn or darker; amphithecial cortex 30μ thick, fastigate, brownish throughout; algal layer 25μ thick, of closely packed colonies, nearly continuous at the margin, with an occasional algal cell penetrating the cortex; algal layer under the parathecium 35μ thick, continuous or nearly so; parathecium 35μ thick, with papilliform projections extending downward another 50μ , pushing the algal layer down into the loose medulla, of very thickwalled, fastigate pseudoparenchyma; hypothecium 15μ thick, of gelified periclinial hyphae, not staining; thecium 80μ tall; paraphyses slender, twice or thrice dichotomous above the asci, tips clavate, brownish, $10 \times 4 \mu$, reaching the surface of the brownish epithelial gel; asci cylindric clavate, $50 \times 22 \mu$, walls 3μ thick, tips 7μ when young, 8-spored; ascospores ellipsoid, $13-23 \times 7-11 \mu$, with thick episore at first, thinning at maturity.

Spermogonia immersed in the thallus and in the margins of the apothecia, oblatly spheroidal, $80\ \mu$ tall, $160\ \mu$ in diameter, wall about $10\ \mu$ thick of very slender periclinal hyphae, hyaline below, blackened about the ostiole; spermatophores $50 \times 1\ \mu$, once or twice dichotomous above; spermatia bacilliform, straight, $6.5 \times 1\ \mu$.

Jaeger 599 is an old thallus with a few lobes showing microphylline margins, apparently regeneration following insect? damage to the margin.

SIERRA LEONE: Loma Mts., corticole, *P. Jaeger 599*, at Kew.

NIGERIA: Nupe, on trees, *Charles Barter*, Niger Exp., at Kew.

SOUTHWEST SUDAN: Djur, Scriba Ghattas, lignicole, *Schweinfurth* at Farlow Herb.

NON-AFRICAN SPECIES

Parmelia cristifera Taylor and *P. saccatiloba* Taylor have often been misinterpreted since their publication before the use of microscopic characters, hence it seems desirable to record their characters based on the types in Taylor's herbarium, now at the Farlow Herbarium.

PARMELIA CRISTIFERA Taylor, London Jour. Bot. 6:165. 1847.

Type: India, Calcutta, *Wallich*, in Taylor Herb. at Farlow Herb.; Brazil, *Gardner*, also cited. Since this specimen is probably a later Brazilian species, the former may be taken as the type of *P. cristifera*.

Thallus at least 30 cm. in diameter, deep olive buff, surface reticulate rimose in center, less distinctly so at the margins, very coarsely and predominantly radially rugose; lobes imbricate, central lobes rounded, about 15 mm. wide and long, margins very crisped and suberect, with subspherical soralia, 0.5 mm. in diameter, mostly confluent into a continuous band, with occasional similar soralia scattered over the surface but not submarginal; underside black to the margins, or narrowly decolored and almost white below the soredia, eciliate; rhizinae not seen as the thallus is closely glued to the herbarium sheet; upper cortex $45\ \mu$ thick, fastigiate, the outer $25\ \mu$ a greenish brown layer of very thickwalled, conglutinate cells $25 \times 9\ \mu$, formed by dichotomy of erect hyphae just under the layer, the rest hyaline, slightly nubilated with grayish granules and an occasional algal cell pushing up between the cortical hyphae; algal layer 15–20 μ thick, of colonies of *Trebouxia* in a nearly continuous layer, so heavily nubilated with brownish granules that structure is not clear, cells 4–5 μ in diameter; medulla K yellow, C–, KC– (atranorine and salacinic acid, fide Hale, annotation, 1957), 100 μ thick, the upper two thirds heavily nubilated with grayish granules, of very thickwalled, longitudinal hyphae, 3 μ in diameter, very closely woven, the lower third with few granules and somewhat more loosely woven, tending to tear in this zone in sectioning; lower cortex black, 25 μ thick, of fastigiate pseudoparenchyma; marginal soredia formed by bursting of the cortex, the medullary hyphae protruding with colonies of algae spreading over their tips, forming soredia 30 μ in diameter.

Apothecia 1.5–2 mm. in diameter, probably becoming larger, margins thick, inrolled, entire to very slightly crenate, probably finally sorediose, exciple smooth,

disc ochraceous tawny to buckthorn brown; amphithecial cortex $65\ \mu$ thick, fastigiate, the outer cells $40 \times 10\ \mu$, less conglutinate than in the thalline cortex, the rest more pseudoparenchymatous; algal layer $65\ \mu$ thick, of closely packed colonies, occasionally pushing up through a break in the cortex (to form soredia?), algal layer under the parathecium $30\ \mu$ thick, continuous; parathecium $30\ \mu$ thick, of fastigiate, thickwalled pseudoparenchyma; hypothecium $15\ \mu$ thick, of slender periclinial hyphae; thecium $130\ \mu$ tall; paraphyses slender, dichotomous above the asci, tips clavate to subspherical, $4\ \mu$ in diameter, covered by a pale brownish epithecial gel; asci $70 \times 30\ \mu$, wall about $3\ \mu$ thick, tips thicker, 8-spored; ascospores ellipsoidal, $26 \times 15\ \mu$, episore $3\ \mu$ thick; both asci and ascospores resembling those organs of the Pertusariaceae but smaller.

PARMELIA (AMPHIGYMNIA) *Gardneri* Dodge, sp. nov.

Type: Brazil, without locality,¹ *George Gardner*, in Taylor Herb. sub *P. cristifera* Tayl., at Farlow Herb.

Thallus 10 cm. diametro, obscure olivaceo-alutaceus, K dilute flavescens; lobis periphericis imbricatis, 10–20 mm. latitudine, 25 mm. longitudine, crenatis, sinibus acutis, anguste nigromarginatis, laevibus, crispatis; lobis centralibus minoribus, irregularibus, marginibus sorediosis, crispatis, sinibus rotundatis, non nigromarginatis; soralia capitata mox confluentia; infra niger, marginibus obscure brunneis, rhizinis non visis; cortex superior $30\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, hyphis $6\ \mu$ diametro, protoplastis sphaericis, $3\ \mu$ diametro; stratum algarum 13–15 μ crassitudine, coloniis *Trebouxiae*, subcontinuum, cellulis $6\ \mu$ diametro; medulla K–, C–, KC– aut dilutissime flavescens, $90\ \mu$ crassitudine, hyphis pachydermeis longitudinalibus dense intertextis, nubilatis; cortex inferior $20\ \mu$ crassitudine, pseudoparenchymatice fastigiatus, cellulis 3–4 μ diametro.

Apothecia 4 mm. diametro, sessilia, submarginalia, marginibus sorediosis, ex-cipulo rugoso subscrobiculato, disco castaneo; cortex amphithecialis $115\ \mu$ crassitudine, pseudoparenchymatice fastigiatis, hyphis $10\ \mu$ diametro, protoplastis sphaericis $2\ \mu$ diametro; stratum algarum $30\ \mu$ crassitudine, subcontinuum; stratum algarum sub parathecio $65\ \mu$ crassitudine, coloniis densis; parathecium $50\ \mu$ crassitudine, fastigiatum, hyphis $3\ \mu$ diametro; hypothecium $30\ \mu$ crassitudine, hyphis tenuibus periclinalibus; thecium $135\ \mu$ altitudine; paraphyses tenues, septatae, apicibus non incrassatis; asci clavati, $80 \times 23\ \mu$; ascospores octonae, ellipsoideae, $16-20 \times 10-12\ \mu$, episporio $2.5\ \mu$ crassitudine.

Thallus 10 cm. in diameter, deep olive buff (1957), K pale yellow, peripheral lobes imbricate, 10–20 cm. wide, about 25 mm. long, coarsely but deeply crenate, sinuses mostly acute, rarely rounded, narrowly black margined, smooth, larger lobes crisped; central lobes smaller, more irregular, margins crisped, capitate soraliate, soralia 0.5 (–1) mm. in diameter, soon confluent into a marginal band, sinuses rounded, sometimes margins of sinuses slightly dentate, mostly smooth, not black-margined, wholly eciliate; underside of peripheral lobes black or very dark brown

¹ Eastern tropical Brazil, probably between Ceará and Pernambuco or along the São Francisco River in western Bahia and eastern Piauí, as Gardner's specimens from the Serra das Orgãos are usually labeled Organ Mts. in Taylor's herbarium.

to the margins, smooth to minutely rugulose, shining; margins of sorediiferous lobes warm buff or lighter, occasionally irregularly so; rhizinae not seen; upper cortex $30\ \mu$ thick, of fastigate pseudoparenchyma, hyphae $6\ \mu$, protoplasts spherical $3\ \mu$, the outer $10\ \mu$ brownish; algal layer $13\text{--}15\ \mu$ thick, a nearly continuous layer of colonies of *Trebouxia*, cells $6\ \mu$ in diameter; medulla K-, C-, KC very faint yellowish, perhaps dye diffusing from the cortex, $90\ \mu$ thick, of longitudinal thick-walled hyphae, very closely woven, heavily nubilated, looser and less nubilated in the lower $10\ \mu$; lower cortex $20\ \mu$ thick, of fastigate pseudoparenchyma, hyphae thickwalled, $3\text{--}4\ \mu$ in diameter.

Apothecia 4 mm. in diameter, sessile or nearly so, submarginal, margins a narrow band of granular soredia, exciple rugose to subscrobiculate, disc chestnut; amphithecial cortex $115\ \mu$ thick, of fastigate pseudoparenchyma, hyphae $10\ \mu$ in diameter, protoplasts spherical, $2\ \mu$ in diameter; algal layer $30\ \mu$ thick, subcontinuous; medulla $350\ \mu$ thick; algal layer under the parathecium $65\ \mu$ thick, of discrete, closely packed colonies; parathecium $50\ \mu$ thick, fastigate, hyphae conglutinate, $3\ \mu$ in diameter, protoplasts $2\ \mu$; hypothecium $30\ \mu$ thick, of closely woven, slender, periclinal hyphae; thecium $135\ \mu$ tall; paraphyses slender, septate, tips not enlarged, ending about $7\ \mu$ below the surface of the brownish epithelial gel; asci clavate, $80 \times 23\ \mu$, moderately thickwalled, 8-spored; ascospores ellipsoidal $16\text{--}20 \times 10\text{--}12\ \mu$, epispore $2.5\ \mu$ thick.

This species differs from *P. cristifera* Taylor from India, in the larger dimensions of most parts of the apothecium, smaller ascospores and negative reaction of the medulla with K.

BRAZIL: without locality, *George Gardner*, in Taylor Herb. sub *P. cristifera* cited in the original description, at Farlow Herb.

PARMELIA (AMPHIGYMNIA) SACCATILOBA Taylor, London Jour. Bot. 6:174. 1847.

Type: Pitcairn Island, *Beechey*, corticole, in Taylor Herb., at Farlow Herb.

Thallus 14 cm. or more in diameter, center pinkish buff, some peripheral lobes olive buff (1957), lobes rounded up to 25 mm. wide, 20 mm. long, very convex, margins coarsely crisped, from slightly dentate to short isidiose and lobulate, lobules up to 1.3 mm. long, cuneate, 0.3 mm. wide at the base, 0.8 mm. at the truncate apex; surface smooth, reticulate rimose in the older portions with patches of moderately dense to very dense short coralloid isidia, appearing granular under low magnifications; underside wholly black to the margins of central lobes, shading to cinnamon buff on some peripheral lobes; rhizinae not seen as thallus is glued to the herbarium sheet; upper cortex $30\ \mu$ thick, fastigate, hyphae arising from the medulla twice closely dichotomous above the algae, the branches soon parallel, $6\ \mu$ in diameter, the upper $10\ \mu$ nubilated with yellowish green granules, cells nearly isodiametric, conglutinate; algal layer $15\ \mu$ thick, cells in rows between vertical medullary hyphae, spherical, $6\ \mu$ in diameter, not filamentous; medulla K-, C-, KC-, $200\ \mu$ thick, of very closely woven longitudinal hyphae, $6\ \mu$ in diameter, very heavily nubilated with grayish granules, tearing very easily about $15\ \mu$ from the lower cortex; lower cortex black, $15\text{--}25\ \mu$ thick, apparently pseudoparenchymatous from longitudinal hyphae, but so carbonaceous that I have been unable to cut sections thin enough to see clearly.

Apothecia up to 6 mm. in diameter, substipitate, margin and upper part of the exciple granular isidiose, exciple otherwise smooth, disc chestnut; amphithecial cortex $25\ \mu$ thick, fastigate as in the thalline cortex; algal layer $15\ \mu$ thick, continuous; medulla very closely woven, very heavily nubilated next the algal layers; algal layer under the parthecium $40\ \mu$ thick, of closely packed colonies of *Trebouxia*, subcontinuous; parathecium $35\ \mu$ thick, the lower half of very thickwalled periclinal pseudoparenchyma, lumina $1\ \mu$ in diameter, the upper half similar with larger lumina, about $2\ \mu$ in diameter and more deeply staining; hypothecium $20\ \mu$ thick, of very slender more loosely woven periclinal hyphae with longer cells, not deeply staining; thecium $140\ \mu$ tall; paraphyses slender, septate, once or twice dichotomous near the clavate tips, $3\ \mu$ in diameter, ending about $7\ \mu$ below the surface of the pale brownish epithecial gel; asci clavate, $80 \times 28\ \mu$, 8-spored, wall about $4\ \mu$ thick, tips thicker; ascospores ellipsoidal, $20-23 \times 13\ \mu$, episore $2.5-3\ \mu$ thick.

PSEUDEVERNIA

PSEUDEVERNIA Zopf, Beitr. Bot. Centralbl. 14:124. 1903.

Parmelia sect. *Everniiformes* Hue, Nouv. Arch. Mus. [Paris] IV. 1:135. 1899.

Parmelia subg. *Euparmelia* sect. *Everniaeformes* Zahlbr. in Engler & Prantl, Nat. Pflanzenfam. I. 1*:212. 1907.

Type: *Parmelia furfuracea* (L.) Ach.

Thallus polyphyllous, usually medium to large, but rather small in some of our African species, erect to decumbent or pendent, mostly attached at or near the bases of the lobes, lobes linear to lanceolate, dichotomous, margins often sparsely ciliate, cilia occasionally making contact with a substrate and functioning as rhizinae; underside usually dark, sometimes shading to light colored at the tips of the lobes, rarely wholly light colored below, rhizinae dense to sparse or absent, usually not functional; upper cortex of fastigate pseudoparenchyma, algae *Trebouxia*; medulla of closely woven but not conglutinate longitudinal hyphae, sometimes more loosely so just under the algal layer; lower cortex pseudoparenchymatous from longitudinal hyphae, rarely of fastigate pseudoparenchyma. Apothecia not common, relatively large, substipitate.

Pseudevernia is closely related to *Everniopsis*, but lacks the conglutinate hyphae of the medulla forming a sclerotic ribbon and is less rigid when dry. The erect to decumbent species of *Omphalodium* are very rigid when dry, almost woody. *Pseudevernia* is rare or seldom collected in tropical Africa, being much more common with many more species in tropical America.

1. Thallus isidiose, small, lobes 1-1.5 mm. wide; habit of *Parmelia caraccensis*, presumably densely rhizinose below; Mauritius.....*P. mauritiana* (Gyelnik) Dodge
1. Thallus sorediose; medulla K-, C-.....2
1. Thallus neither isidiose nor sorediose.....3
 2. Margins and adjacent upper surfaces soraliate, dirty yellow, lobes up to $25 \times 1.5-5$ mm.; underside black reticulate, nude or with rare rhizinae; Cameroons.....*P. kamerunensis* (Steiner) Dodge
 2. Soralia small, confluent on upper surface, pale dirty green, linear multifid, canalliculate below at the tips, with a few rhizinae; lobes pinnatifid, tips digitate palmate; Cape of Good Hope.....*P. molliuscula* (Ach.) Dodge
 2. Saxicole; nomen nudum.....*P. molliuscula* v. *kilimanjaroensis* Stein

3. Thallus pale yellow or yellowish green, 12–13 mm. tall, terete or compressed, lobes 2–4 mm. wide, tips multifid; underside pale brown, sparsely rhizinose; medulla K yellow then orange red; Cape of Good Hope.....*P. thamnidiella* (Stirton) Dodge
3. Thallus ashy to pale green, lobes flattened.....*P. thamnidiella* (Stirton) Dodge
4. Epiphyllous; poorly described; Tanganyika.....*Parmelia kampschadalis* v. *epiphylla* Cengia Sambo
4. Corticole; apothecia subpedicellate, disc subtestaceous; lobes narrow, canaliculate; underside black, without rhizinae; medulla K pale yellow rufescent, C–, KC pale yellowish; Cape of Good Hope to Angola.....*P. polita* (Fr.) Dodge

The following species of *Pseudevernia*, of which I have seen no specimens, have been described from Africa.

PSEUDEVERNIA mauritiana (Gyelnik) Dodge, comb. nov.

Parmelia caraccensis f. *isidiosa* Müll. Arg., Flora 74:375. 1891.

Parmelia mauritiana Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Type: Mauritius, without collector, at Kew.

PSEUDEVERNIA thamnidiella (Stirton) Dodge, comb. nov.

Parmelia thamnidiella Stirton, Trans. Glasgow Soc. Field Nat. 5:213. 1877.

Parmelia conspersa v. *thamnidiella* Stzbgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1888/9: 153. 1890.

Type: Cape of Good Hope, Somerset East, terricole, *P. MacOwan*.

PSEUDEVERNIA kamerunensis (Steiner) Dodge, comb. nov.

Parmelia kamerunensis Steiner, Verhandl. Zool. Bot. Ges. Wien 53:232. 1903.

Type: Cameroons, Fako, 3600–3800 m., *Alfred Bornmüller*.

Thallus erect in pulvinate tufts, 3 cm. tall, upper surface cream buff, very narrowly black margined with scattered marginal cilia up to 2 mm. long, closely thrice dichotomous in the middle, a few making contact with a solid surface, forming a small black disc holdfast from which radiate 4 short branches; underside black shading to much lighter tips, almost cream buff, transversely reticulate rugose; soralia at first marginal, forming at the junction of the upper and lower cortices, with slightly elevated margins, spreading over the upper surface, about 0.2 mm. in diameter, then new ones burst the upper cortex and become confluent until the upper cortex has been eroded and disappears, soredia about 30 μ in diameter; upper cortex 16 μ thick, of fastigate pseudoparenchyma, cells 3.5 μ in diameter, protoplasts about 1 μ ; algal layer 20 μ thick, of subcontinuous colonies of *Trebouxia*; medulla K–, C–, KC yellowish, 90 μ thick, of closely woven longitudinal hyphae 3.5 μ in diameter, lumina 1.5 μ , somewhat more loosely woven next the algal layer; lower cortex 13 μ thick, outer surface dark brown, very highly gelified, of about 3 layers of somewhat interwoven longitudinal hyphae, protoplasts spherical, 1 μ in diameter. Apothecia not seen.

Spermogonia rare, black, very slightly emergent, not sectioned owing to scanty material available.

ETHIOPIA: Chokke Mts., ca. 10° 40' N., 37° 45' E., north of Debra Marcos, below Talo, 4030 m., epiphyte on *Erica*, R. G. Hiller L86, C.B.E.E., at Kew.

UGANDA: Bugishu, Bulabuli, 2900 m., in bamboo forest, A. S. Thomas 549 p. p. min., at Kew.

TANGANYIKA: Kilimanjaro, 2900–3025 m., on giant heather in clearings (former fires, in rain forest, R. G. Turrall 55 p. p. min., juvenile, at Kew.

PSEUDEVERNIA molliuscula (Ach.) Dodge, comb. nov.

Parmelia molliuscula Ach., Lichenogr. Univ. 492. 1810.

Parmelia conspersa f. *molliuscula* Vainio, Termesztetr. Füzetek 22:280. 1899.

Type: Cape of Good Hope, *Thunberg*.

Thallus 5 cm. or more tall, pale virescent (now 1957 cinnamon) K-, C bleached to white, probably suberect to decumbent (Acharius states "substellata . . . vix stellatus"), lobes more or less linear from a common holdfast, up to 5 mm. broad below, irregularly dichotomous, subpinnate on the sides and palmate digitate above, narrowing at each dichotomy, ultimate lobules 2-3 mm. long, 1-1.5 mm. wide, tips rounded or obtuse, convex below becoming canaliculate at the lobules and smaller branches, quite fragile when dry; underside snuff brown to Saccardo's umber, smooth to minutely reticulate rugulose, nearly nude; rhizinae few, rarely submarginal, usually near the center of the lobe, solitary, rather stout, about 1 mm. long, concolorous; upper cortex 30 μ thick, upper half gelified, heavily nubilated with pale brownish granules, lower half of thinner-walled pseudoparenchyma, cells 4-5 μ in diameter, somewhat irregularly arranged; algal layer 25-30 μ thick, of close, discrete colonies of *Trebouxia*, heavily nubilated with grayish granules, cells 5-6 μ in diameter; medulla K-, C-, KC-, 200 μ thick, of moderately closely woven, dichotomous, thickwalled hyphae, irregularly arranged but predominantly longitudinal, 5-6 μ in diameter, heavily but irregularly nubilated by pale brownish granules; lower cortex 15 μ thick, pale, of fastigate pseudoparenchyma, lumina about 1 μ in diameter, somewhat irregularly arranged. Apothecia unknown.

CAPE OF GOOD HOPE: *Zeyher*, ex Kunze herb. sub *Evernia*? det. *P. molliuscula* by Tuckerman, in Tuckerman Herb. at Farlow Herb.

PSEUDEVERNIA polita (Fr.) Dodge, comb. nov.

Parmelia polita Fr., Syst. Orb. Veg. 283. 1825.

Type: Cape of Good Hope.

Thallus erect, over 3 cm. tall, pale olive buff, convex above, surface white reticulate and somewhat minutely rimulose, branching unequally dichotomous, eciliate, lobes about 2 mm. wide at the moribund base, narrower at each dichotomy; underside canaliculate, black, reticulate rugose with scattered slender rhizinae about 0.5 mm. long, somewhat closer and coarser with dichotomous tips near the apices of the lobes; upper cortex 15-20 μ thick, of fastigate pseudoparenchyma, the outer half densely nubilated with minute brownish granules; algal layer of discrete colonies of *Trebouxia*, 20-25 μ in diameter, subcontinuous, cells 6-7 μ in diameter; medulla K pale yellow rufescent, C-, KC pale yellowish, 50 μ thick, of very closely woven longitudinal hyphae with occasional transverse strands, hyphae thickwalled, 3-4 μ in diameter; lower cortex black, 6-7 μ thick, of conglutinate, longitudinal hyphae, closely septate with moderately thick walls, 3.5 μ in diameter.

Apothecia superficial, 6 mm. in diameter, pedicel 2 mm. tall, 1.8 mm. in diameter, margins inrolled when dry, exciple smooth, disc brick red, apparently dying or more probably eaten by insects and the parathecium regenerating as cortex in the center; not sectioned as only one apothecium present in our material.

Fries' very brief description agrees with our material, but I have not seen the type nor an amplified description based on the type.

ANGOLA: Cuanza Sul, Amboim, Capir near the Carloaongo-Cuvo River, 1000 m., on dead trees, *J. Gossweiler* 9991, 9993 p. p. min., at Kew.

CAPE OF GOOD HOPE: Saldanha Bay, without collector, herb. Hookerianum, growing with *Omphalodium hypoleium* (Nyl.) Dodge, at Kew.

EVERNIOPSIS

EVERNIOPSIS Nyl., Syn. Meth. Lich. 1:374. 1860.

Parmelia sect. *Everniopsis* Stzgr., Ber. Thätigk. St. Gall. Naturw. Ges. 1862:174. 1862.

Hendrickxia Duvigneaud, Bull. Jard. Bot. Etat Bruxelles 16:357. 1942.

Type: *Parmelia trulla* Ach. The type of *Hendrickxia* is *H. pseudoreticulata* Duvigneaud.

Thallus erect or pendent, not rigid, 7.5–12.5 cm. long, flat or canaliculate above, 4 mm. or less wide below, dichotomously branched, eciliate, light colored below, smooth without rhizinae; morphologic upper cortex of fastigate thick-walled pseudoparenchyma; algal layer continuous, cells closely packed, probably *Trebouxia*; medulla completely sclerotic, of conglutinate thickwalled hyphae, fraying out into loosely woven hyphae of the medulla of the apothecia; morphologic lower cortex of conglutinate longitudinal hyphae similar to the medulla but the hyphae are larger with smaller lumina.

Apothecia submarginal, substipitate, relatively large, exciple longitudinally rugose, disc remaining concave, imperforate, chestnut or darker; parathecium of conglutinate, very thickwalled periclinal hyphae; asci 4–8-spored, rather thick-walled, tips not thicker; ascospores ellipsoid, $11\text{--}16 \times 7\text{--}10 \mu$ with a thick epispore, protoplasts roughened as in the Pannariaceae. Spermatogonia of the type usually found in the Parmeliaceae.

E. pseudoreticulata is epiphytic in subalpine areas in Congo and Uganda. The only other species known, *E. trulla* (Ach.) Nyl., extends from Mexico to northern Chile at high elevations.

In *Everniopsis*, the whole medulla is sclerotic and the structure is dorsiventral, while in the Usneaceae, the structure is radial, with a medulla differentiated from the central sclerotic strand. In all its characters it clearly belongs in the Parmeliaceae rather than in the Usneaceae where it was placed by Zahlbruckner.

EVERNIOPSIS pseudoreticulata (Duvign.) Dodge, comb. nov.

Hendrickxia pseudoreticulata Duvign. Bull. Jard. Bot. Etat Bruxelles 16:359. 1942.

Type: Congo, Mt. Kahusi, 3° S., 3300 m., *F. L. Hendrickx*.

Thallus probably pendent, about 10 cm. long, dichotomously branched, lower internodes about 10 mm. long, the upper somewhat shorter, tips retuse, lobes 2–3 mm. wide below, about 1 mm. above, olive buff, opaque, canaliculate, below Isabella color, somewhat shining, without rhizinae or cilia; upper cortex 16μ thick, fastigate, cells very thickwalled, 8μ in diameter, protoplasts about 3μ ; algal layer $30\text{--}35 \mu$ thick, of closely packed cells $6\text{--}7 \mu$ in diameter; medulla $80\text{--}100 \mu$ thick, of conglutinate, interwoven hyphae, $6\text{--}7 \mu$ in diameter; lower cortex about 25μ

thick, of longitudinal conglutinate hyphae 8–9 μ in diameter, lumen about 1 μ .

Fertile portion at dichotomy widened to 5 mm., somewhat rugose, cortex rimose; apothecia subpedicellate, marginal on the upper surface, 2 mm. in diameter, deeply cupulate, exciple longitudinally rugose, disc very concave, chestnut; amphithecial cortex 30–35 μ thick, of the same structure as the thalline cortex; outer medulla 80–100 μ thick, very loosely woven, of thickwalled hyphae, with single algal cells in the meshes, inner medulla next the hypothecium 30 μ thick, of predominantly periclinal, conglutinate thickwalled hyphae (easily cracking away from the outer medulla on sectioning); hypothecium 20–25 μ thick, of very slender interwoven but mostly periclinal hyphae; thecium 65–70 μ tall; paraphyses slender, conglutinate, lumen about 1 μ in diameter, several times dichotomously branched above the asci; asci subcylindric, 75–80 \times 15 μ , wall 2–3 μ thick, tip not thickened, 4-spored; ascospores ellipsoid, hyaline, unicellular, 16 \times 10 μ , wall rather thick, outer surface of the protoplast slightly rough, suggesting the ascospores of the Pannariaceae.

Spermogonia semiemersed, marginal on the older portions of the thallus below the fertile areas, 115 μ tall, 80 μ in diameter, wall blackened in the upper half, nearly hyaline below, about 8 μ thick, of slender periclinal hyphae; spermatophores 16 \times 1.5 μ , septate; spermatia bifusiform, 6.5 \times 1 μ .

CONGO: Luha, road to Kahusi, epiphyte, *F. L. Hendrickx* 4247, fertile; Kahusi, *F. L. Hendrickx* 4253, sterile; Kahusi, chute de la Luha, *F. L. Hendrickx* 4248, fragment; all in E. African Herb.

UGANDA: Kigezi, Naiguru, 2255 m., in impenetrable forest, *I. R. Dale* L62, fertile, at Kew.

OMPHALODIUM

OMPHALODIUM Mey. & Fw., *Nova Acta Acad. Leopold-Carol.* 19: Suppl. 1:223. 1843; Fw., *Linnaea* 17:27. 1843.

Parmelia subg. *Omphalodium* Nyl. in Hue, *Nouv. Arch. Mus. [Paris]* III. 2:291. 1890.

Type: *O. pisacomense* Mey. & Fw.

Thallus monophyllous or polyphyllous, rigid, attached by a central or somewhat excentric gomphus as in the Umbilicariaceae, upper surface white reticulate, cortical cells under the white areas not conglutinate; cortices of fastigate pseudoparenchyma; algae *Trebouxia* (*Trentepohlia* in *O. convolutum*); medulla C-, K and KC- or orange red in a thin zone just under the algal layer.

Apothecia up to 20 mm. in diameter, mostly smaller, sessile to stipitate; amphithecium present; parathecium of fastigate pseudoparenchyma (fastigate below, periclinal above in *O. hypoleium* and wholly periclinal in *O. mazoensis*); ascospores small to medium in size, hyaline, ellipsoid, unicellular.

There has never been agreement among lichenologists whether this genus should be included in the Umbilicariaceae or the Parmeliaceae. The thallus closely resembles the Umbilicariaceae in many characters while the apothecia and ascospores are like those of the Parmeliaceae.

1. Thallus monophyllous, margin deeply lobed..... 2
1. Thallus polyphyllous..... 3
 2. Margins ciliate, surface ashy green, underside black, rhizinoe..... *O. stictellum* (Mass.) Dodge
 2. Margins not ciliate, surface chestnut brown; underside darker brown, erbozinoe..... *O. umbellatum* (Del.) Dodge
3. Underside nude or with very few scattered rhizinae..... 4
3. Underside rhizinoe, at least on the distal portions of the lobes..... 6
 4. Margins ciliate: algae *Trentepohlia*; lobes inrolled forming a ball, which early breaks away from the gomphus..... *O. convolutum* Hue
 4. Margins eciliate..... 5
5. Lobes flabellate, di- to poly-chotomous, more than 2 mm. wide, mostly wider; underside brown; medulla K yellow then red next the algal layer..... *O. phalacrum* (Hue) Dodge
5. Lobes linear, closely dichotomous, 1-1.5 mm. wide; underside black with an occasional rhizina; medulla K..... *O. hypoleium* (Nyl.) Dodge
6. Rhizinae confined to distal portions of lobes..... 7
6. Rhizinae covering the whole underside..... 8
7. Lobes cuneate, apothecial margins ciliate; upper cortex of thinwalled pseudoparenchyma..... *O. ceranoides* (Lam.) Dodge
7. Lobes rounded, apothecial margin eciliate, exciple rugose scrobiculate; upper cortex of thickwalled pseudoparenchyma..... *O. pachyballum* (Sprgl.) Dodge
 8. Primary lobes cuneate, 10 mm. wide, ultimate lobules narrow, 10 mm. long; exciple ciliate; parathecium of fastigate pseudoparenchyma; ascospores $10 \times 5 \mu$ *O. bottentottum* (Thunb.) Fw.
 8. Primary lobes rounded, 10 mm. long, 5 mm. wide; margin very sparsely ciliate; exciple eciliate, scrobiculate; parathecium of periclinal pseudoparenchyma; ascospores $12-13 \times 6-7 \mu$ *O. mazoense* Dodge

OMPHALODIUM stictellum (Mass.) Dodge, comb. nov.

Parmelia stictella Mass., Mem. Ist. Veneto Sci. Lett. Arti. 10:52. 1861.

Type: Cape of Good Hope, *Heinrich Wawra*.

Thallus monophyllous, rigid, 5-9 cm. in diameter, deep lichen green or darker, some ultimate lobes discolored pinkish cinnamon, center continuous, peripheral lobes 10 mm. long, 8-10 mm. wide, rounded, sinuses rounded to excised; margins very closely ciliate, cilia 0.8 mm. long, coarse, tips obtuse; surface closely white reticulate, smooth; gomphus 5 mm. in diameter, of densely interlaced fibers; underside sayal brown or darker, nude, deeply reticulate rugulose in the center, shading to black, densely rhizinoe on the peripheral lobes, rhizinae 1-1.5 mm. long, tips acute; upper cortex 40-50 μ thick, of fastigate pseudoparenchyma, cells about 4 μ in diameter with moderately thick walls, very heavily nubilated with brownish granules in the outer 30 μ , interrupted by non-conglutinated cells and non-nubilated areas (the white lines of the upper surface; algal layer 30 μ thick, continuous with occasionally close, discrete colonies of *Trebouxia*, cells 7-8 μ in diameter; medulla K and KC orange next the algal layer, the rest negative, C-, 135 μ thick, of closely woven, longitudinal, thickwalled hyphae, 3-4 μ in diameter, heavily nubilated with grayish granules in the upper 40 μ ; lower cortex black, 15 μ thick, of a single layer of pyriform, thickwalled cells, very closely packed, $15 \times 5-6 \mu$; rhizinae 140 μ in diameter, formed by the outgrowth of the medullary hyphae, corticate by cells from the lower cortex.

Apothecia superficial and submarginal, sessile, up to 5 mm. in diameter, margin entire, inrolled when dry, ciliate, cilia 0.5 mm. long, blunt; exciple smooth lichen green, stained orange in places; disc concave, finally nearly plane, auburn or darker; amphithecial cortex 15 μ thick, fastigate, gelified, lumina 1 μ in diameter; algal layer of very scattered cells and very small colonies; medulla thick, nubilated above with grayish granules; algal layer under the parathecium 55 μ thick, nearly continuous with occasional cells pushing up between the parathecial hyphae; para-

thecium $40\ \mu$ thick, of fastigate pseudoparenchyma, protoplasts $1\ \mu$ in diameter, deeply staining in the upper $15\ \mu$; hypothecium $15\ \mu$ thick, of slender, periclinal hyphae, closely interwoven, deeply staining; thecium $55\ \mu$ tall; paraphyses slender, several times dichotomous above the asci, tips pyriform, $3\ \mu$ in diameter, reaching the surface of the brownish epithelial gel; asci clavate, $40 \times 8\ \mu$, tips thickened, protoplast long mammillate when young; ascospores broadly ellipsoid, $8 \times 5\ \mu$ with a moderately thick epispore.

Burchell's collection has somewhat narrower peripheral lobes and a somewhat excentric gomphus.

CAPE OF GOOD HOPE: without definite locality, W. J. Burchell ex herb. W. A. Leighton; District Clanwilliam, top of Packhuis Pass, saxicole; O. Almborn, Lich. Africani 17, both in Dodge Herb.

OMPHALODIUM CONVOLUTUM Hue, Nouv. Arch. Mus. [Paris] IV. 2:111. 1900.

Parmelia convoluta Zahlbr., Cat. Lich. Univ. 6:272. 1929 non Krmph.

Parmelia Hueana Gyelnik, Repert. Sp. Nov. Reg. Veg. [Fedde] 29:288/416. 1931.

Type: South West Africa, Walvis Bay, *Duparquet*, on sand.

Thallus 6 cm. or more in diameter, buffy brown, white punctate to reticulate; no trace of gomphus which has broken off and healed over, base 1 mm. wide rapidly expanding to a cuneate lobe 7 mm. wide, giving rise to 7 secondary lobes 1-3 mm. wide, irregularly dichotomous to subpinnate, again branched or lobulate, margin with close cilia 3-4 mm. long, broad at the base, tapering to an acute tip; lobes inrolled when dry, forming a black ball; surface smooth; underside black, longitudinally rugose with a few punctate ecorticate areas (similar to pseudocyphellae but medullary hyphae not protruding); upper cortex very variable in thickness, $65-100\ \mu$ thick, the outer layer $20\ \mu$ thick, of fastigate pseudoparenchyma, hyphae $3\ \mu$ in diameter with moderately thick walls, heavily nubilated with brownish granules, almost obscuring structure, a middle layer $15-20\ \mu$ thick gelified, of longitudinal hyphae, lumina $1\ \mu$ thick or less, and an inner layer, fastigate, $20-55\ \mu$ thick, hyphae dichotomous, $6-7\ \mu$ in diameter, sparingly septate; with apotheciiform thickenings $800\ \mu$ wide, where the outer layer becomes $25\ \mu$, the middle layer $65\ \mu$ and the inner layer $115\ \mu$ thick, with columns of algae varying in width pushing up through the lower layer; algae *Trentepohlia* in a zone $30-65\ \mu$ thick, of more or less longitudinal filaments $6-7\ \mu$ in diameter, septate into nearly isodiametric cells, separated in places by strands of medullary hyphae which form the lower layer of the cortex, the algal filaments giving rise to vertical branches to form the columns of algal filaments which may reach the surface in cracks between the normal cortex and the apotheciiform enlargements, no terminal zoosporangia certainly seen, although a few terminal cells become spherical, $10\ \mu$ in diameter; medulla K-, C-, KC-, $165\ \mu$ thick, of interlaced strands of dichotomous hyphae $6-7\ \mu$ in diameter, sparsely septate, lumina about $2\ \mu$ in diameter, heavily nubilated with grayish brown granules for a variable distance below the algal layer, irregularly distributed, with cavities $50\ \mu$ in diameter to within $40\ \mu$ of the lower cortex, partly filled with algal filaments projecting from the walls; lower cortex $7-15\ \mu$ thick, black, of interlaced hyphae $3-4\ \mu$ in diameter, septate into cells varying from $4-8\ \mu$ long, with thick brown walls. Apothecia and spermatogonia not seen.

Our specimens are somewhat smaller than the type, but agree otherwise.

CAPE OF GOOD HOPE: without locality, C. F. Ecklon, ex herb. Sbarbaro sub *Parmelia pachyballa* at Farlow Herb.

OMPHALODIUM phalacrum (Hue) Dodge, comb. nov.

Omphalodium hottentottum v. *phalacrum* Hue, Nouv. Arch. Mus. [Paris] IV. 2:210. 1900.

Type: Cape of Good Hope, Groenkloof, Breutel sub *Parmelia reticulatum* Nees von Esenbeck, cotype, at Farlow Herb.

Thallus polyphyllous, holdfast 15 mm. in diameter, composed of coarse, interlaced rooting fibers penetrating the soil; upper surface rough, black, giving rise to many erect or decumbent lobes about 30 mm. long, stipes flattened, about 5 mm. tall, then closely dichotomous to polychotomous producing strapshaped to subflabellate lobes 10–15 mm. long, 2–5 mm. wide, margins smooth, revolute, tips rounded to truncate, upper surface avellaneous to vinaceous buff, minutely white reticulate; underside Natal brown to bone brown, smooth or slightly longitudinally rugulose, nude on the lobes, two rhizinae seen on the stipes, 1 and 3 mm. long, tip branched, branches enclosing grains of sand in one case; upper cortex 30 μ thick, but sometimes extending to 140 μ between algal colonies to make contact with the medulla, of fastigate pseudoparenchyma, cells 3 μ in diameter, slightly nubilated; algal layer rather variable in thickness, mostly about 55 μ thick, of discrete colonies in a nearly continuous layer, cells 8 μ in diameter, with some colonies pushing up columns of algal cells nearly to the outer surface of the cortex, then simulating *Trentepohlia* with nearly isodiametric cells, and an occasional algal cell lower in the medulla; medulla K slowly yellow then reddish, C–, KC–, 185–200 μ thick, of densely woven thickwalled hyphae 3 μ in diameter; lower cortex 50 μ thick, of fastigate pseudoparenchyma, the outer 15 μ brownish and heavily nubilated, the rest hyaline and the hyphae less closely septate.

Apothecia immature, 3–5 mm. in diameter, margin inrolled, becoming crenulate, exciple smooth, disc rufous; amphithecial cortex 30 μ thick, of fastigate pseudoparenchyma, heavily nubilated; algal layer 100 μ thick, of discrete, conical colonies with the apex toward the cortex, about 80–135 μ in diameter at the base, separated by vertical medullary hyphae; medulla rather closely woven; algal layer under the parathecium 25–30 μ thick, undulating, cells closely packed above, less so beneath; parathecium 65–95 μ thick, fastigate, more closely septate and deeply staining above; hypothecium 55 μ thick, of very slender densely woven, deeply staining periclinal hyphae; thecium 40 μ tall; paraphyses coarse, closely septate, ending about 12 μ below the surface of the brownish epithelial gel, dichotomous at the level of the upper part of the asci, tips not enlarged; asci broadly clavate, 25–30 \times 10–13 μ , wall and tips thickened; ascospores ellipsoid, 8 \times 5 μ , only seen in the asci.

As the apothecia are still immature, the dimensions of the thecium, asci and ascospores may be too small.

CAPE OF GOOD HOPE: Groenkloof, Breutel, sub *Parmelia reticulatum* Nees von Esenbeck, cotype, at Farlow Herb.

OMPHALODIUM hypoleium (Nyl.) Dodge, comb. nov.

Parmelia hypoleia Nyl., Syn. Meth. Lich. 1:393. 1860.

Type: Cape of Good Hope, probably saxicole, collector unknown, com. Kunze P. C. 314 sub *Parmelia reticulata* Nees teste Hampe, portion sent to Nylander, rest in Tuckerman Herb. sheet 777, at Farlow Herb.

Thallus 4 cm. in diameter, bone white fide Nyl., buffy brown (1957), lobes 20 mm. or more long, 1–1.5 mm. wide, closely dichotomous, less so above, ultimate lobes up to 2.5 mm. long, 0.5 mm. wide, tips rounded; surface smooth, minutely rimulose, white reticulate to punctate but not pseudocyphellate, very narrowly black margined, deeply transversely cracked below, usually at the axils, axils rounded not excised; eciliate; underside black, opaque, irregularly rugose, slightly verrucose toward the center, an occasional verruca growing out as a stout rhizina, 1 mm. long, forked at an acute angle near the tip; upper cortex 35 (–50) μ thick, fastigiate, gelified, with some brownish granules in the upper 10 μ with areas about 35 μ wide where the hyphae are less dense and not conglutinate, hyphae very thickwalled, lumina scarcely visible, (corresponding to the white areas on the surface); algal layer 25 μ thick, nearly continuous, of colonies of *Trebouxia*, cells 6–7 μ in diameter; medulla K–, C–, KC–, 150 μ thick, of very closely woven predominantly longitudinal, very heavily nubilated with grayish brown crystals, very loosely woven in the lower 10 μ without crystals and easily tearing away from the lower cortex on sectioning; lower cortex 15 μ thick, black, of fastigiate pseudoparenchyma, cells $6 \times 4 \mu$ in diameter extending up the sides and progressively paler as it joins the upper cortex, forming pores 6–10 μ in diameter for aeration.

Apothecia 6–7 mm. in diameter, very abundant and distorted by mutual pressure; margin entire at first, upper part of exciple soon vertically sulcate and margin deeply crenate, almost lobulate, exciple otherwise smooth and slightly white-reticulate but less conspicuously so than the thallus, disc burnt sienna when young, becoming chestnut or darker in age; amphithecial cortex 50 μ thick, of the same structure as the thalline cortex but the hyphae 6–7 μ in diameter, nubilated in the outer 15 μ ; algal layer 30–50 μ thick, but with many lacunae where colonies have disappeared; algal layer under the parathecium 50 μ thick, nearly continuous; parathecium 60 μ thick, the lower 25 μ of thickwalled fastigiate pseudoparenchyma, the rest of conglutinate thickwalled periclinal hyphae, lumina $4 \times 2 \mu$, the outermost 10 μ hyaline (protoplasts scarcely staining) and not conglutinate; hypothecium 7–10 μ thick, of slender periclinal thinwalled hyphae; thecium 60–65 μ tall; paraphyses slender, septate, about once dichotomous above the asci, tips narrowly clavate ending in the brownish epithelial gel; asci $30 \times 10 \mu$ clavate cylindric, wall and tips thick when young; ascospores ellipsoidal, 10–12 (–14) \times 6–7 (–8) μ , with a rather thin epispore.

Zeyher 22 has broader lobes, 2 mm. wide with ultimate lobes shorter and somewhat broader; microscopically it agrees in the structure of the thallus and apothecia.

CAPE OF GOOD HOPE: saxicole, "dedit Kunze, P. C. 314 sub *P. reticulata* Nees teste Hampe," portion of type collection in Tuckerman Herb.; Uitenhage, Zeyher 22 sub *P. mutabilis* Taylor (not type) in Taylor Herb.; both at Farlow Herb.

var. *tenuifidum* (Nyl.) Dodge, comb. nov.

Parmelia hypoleia v. *tenuifida* Nyl. Syn. Meth. Lich. 1:393. 1860.

Type: Cape of Good Hope, ex Carroll Herb.

Differing from the species in narrower lobes, about 1 mm. wide at the base and ultimate lobules 0.25 mm. wide, more convex, very imbricate and suberect; cortex in older portions rimose-areolate, white punctate and reticulate above.

CAPE OF GOOD HOPE: saxicole, Zeyher 66 on sheet with *P. mutabilis* Tayl., not type, in Taylor Herb. at Farlow Herb.; without locality, Carl Ecklon; Soldanha Bay without collector, herb. Hookerianum; both at Kew.

OMPHALODIUM *ceranoides* (Lam.) Dodge, comb. nov.

Lichen ceranoides Lam., Encyclop. Meth. Bot. 3:487. 1789.

Peltigera ceranoides Sprengel, Syst. Veg. 4:1:304. 1827.

Type: Cape of Good Hope.

Thallus 8 cm. in diameter, very rigid when dry, between pale pinkish buff and pale olive buff; holdfast 10 mm. in diameter, of intricately branched rootlets; polyphyllous, lower rank of lobes about 5 mm. broad, cuneate, some lobes unbranched for 15 mm., 20 mm. wide above, others split to within 5 mm. of the holdfast; lateral lobes 3 mm. wide at the base, 15 mm. long, rounded above, margin densely ciliate; upper whorl similar but lobes only 2 mm. wide at the base, more rounded, 20 mm. wide and long; peripheral lobes more variable, some rounded like primary lobes, about 10 mm. wide, others more oblong, 15–20 mm. long, 5–7 mm. wide, all closely ciliate, cilia 1–2 mm. long; surface smooth white reticulate; underside reticulate rugose, ridges predominantly longitudinal, i.e. radial, center nude, auburn or darker, secondary lobes black, densely rhizinose, rhizinae 1 mm. long; upper cortex 15 μ thick, of fastigate thinwalled pseudoparenchyma, cells 3 μ in diameter heavily nubilated with brownish granules; algal layer 50 μ thick, continuous, of single cells and small colonies of *Trebouxia*, cells 7–10 μ in diameter; medulla K–, C–, KC–, 200 μ thick, of moderately closely woven longitudinal hyphae 4–5 μ in diameter, with occasional oblique or transverse hyphae, not nubilated; lower cortex 15 μ thick, of fastigate thickwalled pseudoparenchyma, hyaline, outermost cells blackened; rhizinae 30–80 μ in diameter, formed of medullary hyphae, corticate by a single layer of cells from the lower cortex.

Apothecia short stipitate, deeply urceolate, margin densely ciliate, inrolled, 1.5 mm. in diameter, immature, not sectioned.

CAPE OF GOOD HOPE: Table Mt., rupicole, Breutel, sub *P. hottentotta* ex herb. Sbarbaro, at Farlow Herb.

OMPHALODIUM *pachythallum* (Sprengel) Dodge, comb. nov.

Parmelia pachythalla Sprengel in Nyl., Syn. Meth. Lich. 1:399. 1860.

Parmelia hottentotta v. *pachythalla* Nyl., Syn. Meth. Lich. 1:399. 1860; in Hue, Nouv. Arch. Mus. [Paris] III. 2:292. 1890.

Type: Cape of Good Hope, *Drège* 73.

Thallus at least 8 cm. in diameter, holdfast not seen as thallus glued to herbarium sheet, slate gray toward the margins, K deep red brown, black in the center, margins densely ciliate, cilia 1–2 mm. long from a broad base tapering to the acute apex, rounded lobulate, 5–10 mm. wide and long, varying from smooth to crenate or lacerate lobulate, surface smooth, minutely white reticulate, opaque, with an occasional short cilium; underside black, reticulate rugose with moderately dense rhizinae on the marginal lobes, raw umber in the center, reticulate rugose, nude; upper cortex 15 μ thick, fastigiate, hyphae 6–7 μ in diameter, lumina 1.5 μ , not pseudoparenchymatous, ends of outermost cells rounded and blackened, somewhat nubilated with dark brown granules, covered by an amorphous layer 3–6 μ thick; algal layer 30–50 μ thick, cells mostly solitary, 10 μ in diameter, sometimes in small groups among loosely woven medullary hyphae encrusted with hyaline granules; medulla K–, C–, KC–, 160–200 μ thick, of loosely woven, predominantly longitudinal hyphae, 7 μ in diameter, lumina about 2 μ , encrusted with hyaline granules; lower cortex 15–25 μ thick gelified, fastigiate, hyphae 7 μ in diameter, ends of outer cells rounded and brownish, some areas not gelified, hyphae not closely packed, septate, protoplasts about $6 \times 3 \mu$, brownish, surrounded by the hyaline hyphal wall 3 μ thick, the ends of vertical dichotomous medullary hyphae with large air spaces, a sort of pseudocyphella.

Apothecia 6–10 (–15) mm. in diameter, urceolate at first with inrolled, ciliate margins, becoming plane, margin entire, or coarsely crenate, sometimes cracking into lobes, exciple rugose scrobiculate, warm buff, disc auburn, blackening, imperforate; amphithecial cortex 30–35 μ thick, of fastigiate pseudoparenchyma, lumina subspherical, 2 μ in diameter; algal layer about 50 μ thick, a few cells persisting, most disappearing leaving lacunae between the medullary hyphae; medulla loosely woven, heavily nubilated with brownish granules; algal layer under the parathecium about 50 μ thick, cells quite closely packed, continuous; parathecium 40–45 μ thick, of gelified fastigiate pseudoparenchyma, cells somewhat irregularly arranged above, protoplasts 2 μ in diameter; hypothecium 20 μ thick, of slender gelified periclinial hyphae; thecium 45 μ tall; paraphyses slender, dichotomous above, tips not thickened, ending 6–7 μ below the surface of the epithecial gel; asci and ascospores not seen.

Spermogonia oblate spheroidal, 150 μ tall, 225 μ in diameter, ostiole 35 μ in diameter; wall dark brown, 12–13 μ thick, pseudoparenchymatous from periclinial hyphae; spermatophores flask shaped, base ellipsoid 3 μ in diameter, 8 μ long, tapering to a long neck 50 μ or more long, 1 μ in diameter; spermatia 8–10 \times 1 μ , bacilliform, straight.

CAPE OF GOOD HOPE: Silo, *Brentel* ex herb. Sbarbaro sub *Omphalodium pachythalla*, at Farlow Herb.

OMPHALODIUM HOTTENTOTTUM (Ach.) Flotow, *Linnaea* 17:27. 1843.

Lichen hottentottus Ach., *Lich. Suec. Prodr.* 155. 1798.

Parmelia hottentotta Ach., *Meth. Lich.* 219. 1803.

Sticta hottentotta Ach., *Syn. Lich.* 231. 1814.

Imbricaria hottentotta Schwendener in Maegli, *Beitr. Wiss. Bot.* 3:159. 1863.

Type: Cape of Good Hope, saxicole, *Thunberg*.

Thallus 6 cm. long, probably erect or recumbent; holdfast a disc 8 mm. in diameter of radiating rootlets, base 20 mm. tall, 3 mm. wide, with two lateral branches just above the holdfast, expanding into cuneate lobes 10 mm. wide with rounded tips from which radiate secondary branches 10 mm. wide, bearing ultimate, digitate strap-shaped or cuneate lobes about 10 mm. long; all margins densely short ciliate, clay color shading to pinkish buff, white reticulate; underside clay color, nude at the base, secondary lobes black, short rhizinose; upper cortex 20 μ thick, of fastigate thinwalled pseudoparenchyma, cells 4–5 μ in diameter, heavily nubilated with brownish granules in the outer 10–12 μ ; algal layer 20 μ thick, continuous, cells 5 μ in diameter; medulla C–, K and KC orange next the algal layer, the rest negative, 160 μ thick, of moderately closely woven longitudinal hyphae 4–5 μ in diameter, somewhat incrustated with hyaline crystals, not nubilated; lower cortex 15–20 μ thick, gelified, fastigate, hyphae 3–4 μ in diameter, outer portion dark brown; rhizinae 80 μ in diameter.

Apothecia in the center of the tertiary lobes, up to 12 mm. in diameter, urceolate at first with inrolled entire margins, finally flattened, exciple minutely scrobiculate and very short ciliate; disc imperforate, auburn, darkening; amphithecial cortex 50 μ thick, gelified, fastigate, lumina 1.5 μ in diameter; algal layer about 65 μ thick, continuous, in places disappearing; medulla loosely woven; algal layer under the parathecium 65 μ thick, continuous; parathecium 60 μ thick, of fastigate thickwalled pseudoparenchyma, lumina 2 μ in diameter in the lower half, of periclinal pseudoparenchyma in the upper half; hypothecium 15 μ thick, of thinwalled, closely woven periclinal hyphae 2 μ in diameter; thecium 50 μ tall; paraphyses slender, septate, about twice dichotomous above the asci, tips slightly clavate, reaching the surface of the brownish epithelial gel; asci clavate, 40 \times 13 μ , wall thin, tips 3 μ thick, 8-spored; ascospores ellipsoid, 10 \times 5 μ , with a moderately thick epispore, spuriously 2-celled.

CAPE OF GOOD HOPE: Silo, truncicole, *Breutel*, ex herb. Sbarbaro sub *P. hottentotta*, at Farlow Herb.

OMPHALODIUM mazoense Dodge, sp. nov.

Type: Southern Rhodesia, Mazoe, 1320 m., on dead wood, *Frederick Eyles* 420, at Kew.

Thallus 3 cm. diametro, citrino-ravus, lobis 1 mm. longitudine, 5 mm. latitudine, marginibus integris, apicibus subtruncatis, rotundatis, crenatisve, ciliatis; gomphus eccentricus, 5 mm. diametro, lobulatus; inferne niger, dense rhizinosus, rhizinis ad 2 mm. longitudine, ramosis; cortex superior 15 μ crassitudine, pseudoparenchymatice fastigiatus, cellulis 5–6 μ diametro, granulis brunneis nubilatis; stratum algarum 15 μ crassitudine, subcontinuum, coloniis discretis *Trebouxiae*, cellulis 6–7 μ diametro; medulla K–, C–, KC–, 65–80 μ crassitudine, hyphis longi-

tudinalibus 3 μ diametro; cortex inferior niger, 15 μ crassitudine, pseudoparenchymatice fastigiatus gelifactusque, luminibus 1 μ diametro.

Apothecia urceolata, ad 20 mm. diametro, primum sessilia, dein stipitata, stipite 7 mm. altitudine, 4 mm. diametro, longitudinaliter sulcato, margine crenulato, excipulo scrobiculato, dorsis rugarum albidis sed non rimosis; disco concavo, perforato, castaneo; cortex amphithecialis 80 μ crassitudine, pseudoparenchymatice fastigiatus, hyphis 4 μ diametro, luminibus 1 μ , non nubilatis; stratum algarum 16–20 μ crassitudine, subcontinuum, coloniis discretis; medulla laxa contexta; stratum algarum sub parathecio 20–30 μ crassitudine, coloniis densis; parathecium 15 μ crassitudine, hyphis periclinialibus, 3 μ diametro, luminibus 2 μ , cellulis subisodiametricis; hypothecium 7–10 μ crassitudine, hyphis tenuibus periclinialibus; thecium 65 μ altitudine; paraphyses tenues, septatae, non ramosae, cellula ultima pyriformi, 3 μ diametro; asci clavati, $40 \times 12-13$ μ , leptodermei, apicibus juvenile incrassatis; ascospores octonae, late ellipsoideae, $12-13 \times 6-7$ μ .

Thallus about 3 cm. in diameter, citrine drab shading toward wood brown, lobes 5 mm. wide, 10 mm. long, margins entire, tips subtruncate to more rounded and crenate (variously lacerate) probably short ciliate (a few broken stumps of cilia present); gomphus somewhat eccentric, 5 mm. in diameter, lobulate; underside black to margins, very densely rhizinose, rhizinae up to 2 mm. long, much branched and interwoven; upper cortex 15 μ thick, of fastigate pseudoparenchyma, cells 5–6 μ in diameter, heavily nubilated with brownish granules in the upper 10 μ ; algal layer 15 μ thick, of discrete colonies of *Trebouxia*, cells 6–7 μ in diameter, forming a nearly continuous layer; medulla K-, C-, KC-, 65–80 μ thick, of moderately closely woven longitudinal hyphae, 3 μ in diameter; lower cortex black, 15 μ thick, gelified, of fastigate pseudoparenchyma, lumina 1 μ in diameter, the outer portion very dark brown, lighter next the medulla.

Apothecia up to 20 mm. in diameter, urceolate at first nearly sessile, becoming stipitate; stipe 7 mm. tall, 4 mm. in diameter with longitudinal ridges; margins crenulate, exciple deeply scrobiculate, ridge very high below, lower above, top of ridges white but not rimose; disc chestnut, paler when moist, somewhat uneven, remaining concave, perforate; amphithecial cortex 80 μ thick, of fastigate thick-walled pseudoparenchyma, lumina 1 μ in diameter, hyphae 4 μ , not or only slightly nubilated; algal layer 15–20 μ thick, subcontinuous, of discrete colonies; medulla loosely woven with small air spaces next the algal layer below, more closely woven above; algal layer under the parathecium 20–30 μ thick, of closely packed colonies; parathecium 15 μ thick, of conglutinate periclinial hyphae 3 μ in diameter, lumina 2 μ , forming a pseudoparenchyma; hypothecium 7–10 μ thick, of slender, periclinial hyphae; thecium 65 μ tall; paraphyses slender, septate, unbranched, terminal cell pyriform, 3 μ in diameter; asci clavate, $40 \times 12-13$ μ , thinwalled, tips thickened when young; ascospores broad ellipsoid, $12-13 \times 6-7$ μ .

SOUTHERN RHODESIA: Mazoe, 1320 m., on dead wood, *Frederick Eyles* 420, at Kew.

OMPHALODIUM umbilicatum (Del.) Dodge, comb. nov.

Sticta hottentotta v. *umbilicata* Del., Hist. Lich. Sticta 135. 1822.

Type: Cape of Good Hope, com. Gaudichaud.